TECHNOLOGY DEPT.

A PICTORIAL SURVEY OF CURRENT PRACTICE, EQUIPMENT AND MATERIALS

Construction Methods

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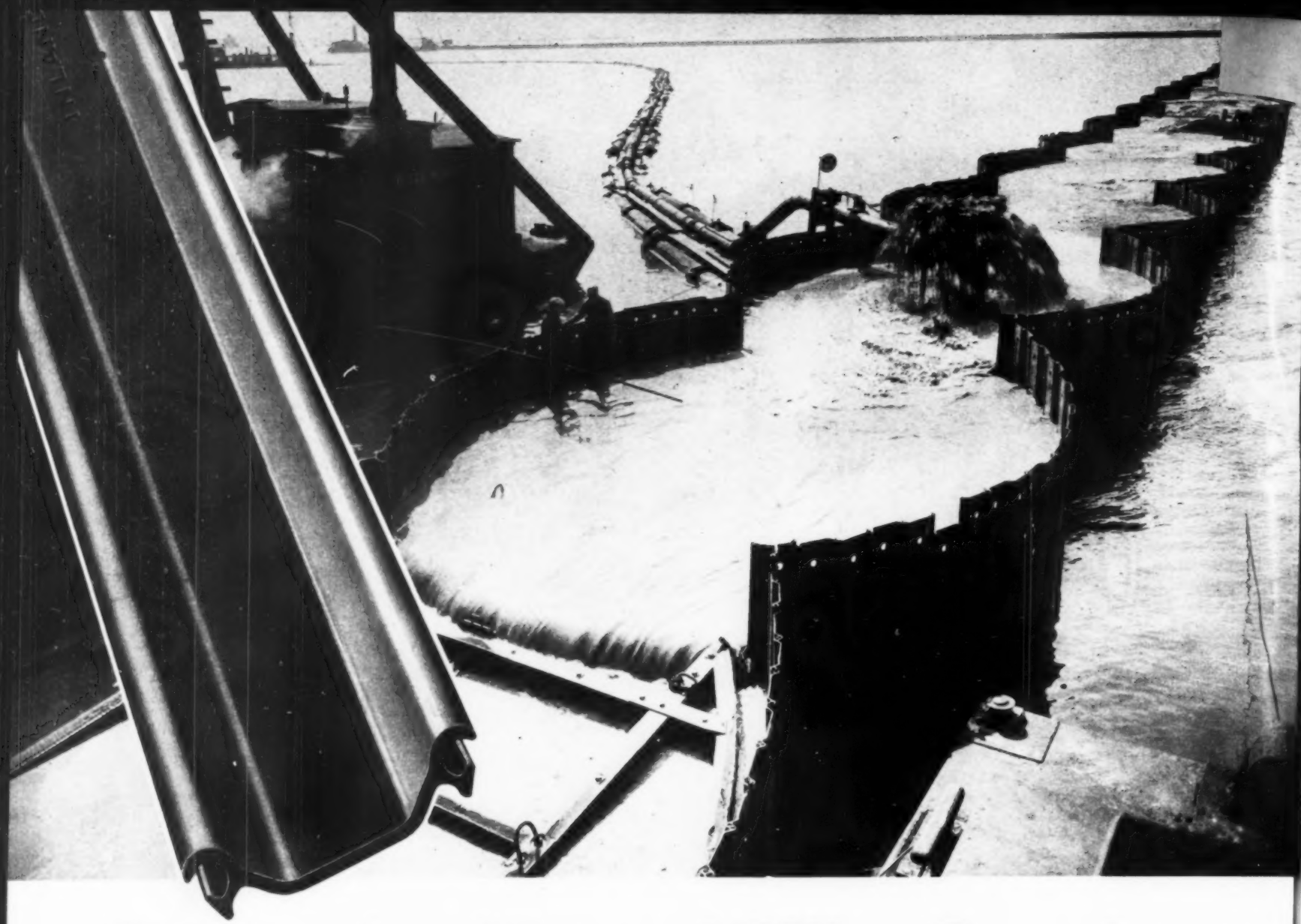


HOT-MIXED ASPHALT is applied by mechanical spreaders to pave runways at Washington National Airport.

AUGUST 1940

NATIONAL AIRPORT RUNWAYS PAVED WITH HOT-MIXED ASPHALT • TWELVE ROCK TUNNELS DRIVEN TO RELOCATE RAILROAD AROUND SHASTA DAM — BY JOHN P. DENSMORE AND ROBERT A. MIDTH TRAVELING SCAFFOLD USED TO REPAIR CONCRETE ARCH VIADUCT • BRIDGES OF FOUR TYPES FOR SYLVANIA TURNPIKE • FOUR-CYLINDER BRIDGE CAISSONS SUNK BY COMPRESSED A

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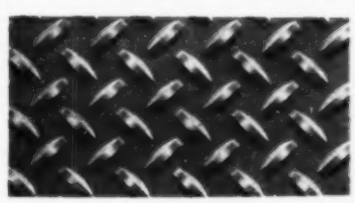


Thousands of Tons of Piling Experience

When a job is unusual, when trouble threatens or when out of the ordinary problems appear, that is the time to rely on experience. That is when contractors need to know what was done on other jobs when other men faced the same kind of situations.

Here is where Inland can give real help because Inland men have handled thousands of piling jobs large and small, representing most every kind of problem. They have helped piling contractors fight their way through to a solution when there were difficulties and troubles on every hand. They have helped find the way to do things that looked at first as if they could not be done.

There is a vast fund of piling experience waiting for you at Inland. Give your next job the benefit of Inland piling plus Inland's helpful experience.



Inland 4-Way Traffic Plate

The safe non-skid surface for bridges, run-ways, etc. Wet or dry it provides full traction in all directions. Cleans and drains easily. Quickly installed, structurally strong, provides years of safe surface.

SHEETS • STRIP • TIN PLATES • BARS • PLATES • FLOOR PLATES
STRUCTURALS • PILING • RAILS • TRACK ACCESSORIES • REINFORCING BARS

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INLAND STEEL CO.

PILING

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CURRENT JOBS

....and Who's Doing Them

BUILDINGS

Public — In Jacksonville, Fla., bachelor officers' quarters and administration building at Naval Air Base will be constructed by **T. A. Loving & Co.**, of Goldsboro, N. C., for $764,600; also a contract for assembly and repair shop at the Air Base went to **Doyle & Russell**, of Richmond, Va., for $763,330. In Quebec, Canada, a $1,000,000 contract for a munition plant was awarded to **Aglin-Norcross Quebec Ltd.**, of Montreal Canada. Another contract for munition plant in Ontario, Canada, went to **Dominion Construction Corp., Ltd.**, of Toronto, Canada, for $10,000,000. General contract for Le Moyne Gardens housing project in Memphis, Tenn., was awarded to **S. & W. Construction Co.**, local contractor, for $1,446,043. In New Britain, Conn., **Southern New England Construction Co.**, of Hartford, will construct the Mount Pleasant housing project for $1,193,900. Successful bidder for additions to Munitions and Navy Department buildings in Washington, D. C. was **McCloskey & Co.**, of Philadelphia, Pa., for $1,422,000. In Ogden, Utah, **Peter Kiewit & Sons Co.**, of Omaha, Neb., will build depot supply building at Hill Field Arsenal for $711,711. In Bremerton, Wash., **The Austin Co.**, of Cleveland, Ohio, was awarded contract to build ammunition and fuel oil storage facilities, also aviation facilities for $7,300,000 on cost-plus-fixed-fee basis. **E. I. du Pont de Nemours & Co.**, of Wilmington, Del., will supervise the construction of a $30,000,000 smokeless powder plant in Jeffersonville, Ind., for the War Department. In Portsmouth, N. H., the **Aberthaw Co.**, of Boston, Mass., will build shipway, barracks, extension buildings and accessories for Navy Department for $1,130,000 on cost-plus-fixed-fee basis. The **Turner Construction Co.**, of New York City, will build a storehouse at New York Navy Yard in Brooklyn, N. Y., for $4,000,000. Contract for powder plant improvements at Navy Submarine Base in New London, Conn., went to **Stone & Webster Engineering Corp.**, of New York, for $1,325,000 on cost-plus-fixed-fee basis.

HEAVY CONSTRUCTION

Successful bidders for Arkabutla dam on Coldwater River in Mississippi were **Forcum James Construction Co.**, of Dyersburg, Tenn., **Pioneer Construction Co.**, of Batesville, Miss., and **H. N. Rodgers & Sons**, of Memphis, Tenn., for $5,158,157. At Fort Supply, Okla., **Leo Sanders**, of Oklahoma City, received contract for outlet and control works and final closure section of Fort Supply Reservoir for $2,920,366. The John Martin dam on the Arkansas River in Caddoa, Colo., will be built by **W. E. Callahan Construction Co., Gunther & Shirley Co.**, local contractors, and **Rohl-Connolly Co.**, of Los Angeles, Calif., for $7,160,754. Contract for dredging San Diego Harbor in San Diego, Calif., went to **San Francisco Bridge Co.**, of San Francisco, for $1,014,300. In Coco Solo, Canal Zone, the **Frederick Snare Corp.**, of New York, received contract to construct breakwater at Naval Air Station for $2,840,000. Hangars for Westover Field in Chicopee Falls, Mass., are under construction by **Tuller Construction Co.**, of Red Bank, N. J., for $1,621,800. In Brantford, Ont., Canada, flying training school buildings will be erected by **Ontario Construction Co., Ltd.**, of St. Catharines, for $750,000. At Naval Air Station in Alameda, Calif., four land-plane hangars will be erected by **Robert E. McKee**, of Los Angeles, for $1,149,000. At Norfolk, Va., **Spencer, White & Prentis, Foley Bros., Inc.**, and **Merritt-Chapman & Scott Corp.**, of New York, will erect shipbuilding docks for $16,175,000. **Frederick Snare Corp.**, of New York, received contract to erect defense and aviation facilities at Naval Air Station at Guantanamo Bay, Cuba, for $5,190,000 on cost-plus-fixed-fee basis.

In Hawaii, T. H., contract for dredging Pearl Harbor and islands in Western Pacific went to **Hawaiian Dredging Co., Ltd.**, of Honolulu, **Raymond Concrete Pile Co.**, of New York, **Turner Construction Co.**, of New York, **Morrison-Knudsen Co.**, of Los Angeles, Calif., **J. H. Pomeroy & Co., Inc.**, of San Francisco, for $30,870,000 on cost-plus-fixed-fee basis. Aviation facilities in Coco Solo, Canal Zone, are under construction by **Lindgren & Swinnerton, Inc.**, of San Francisco, Calif., **Hegeman-Harris Co., Inc.**, of New York and **Tucker McClure**, of Balboa, Canal Zone, for $11,050,000 on cost-plus-fixed-fee basis.

HIGHWAYS AND BRIDGES

Among recent highway and bridge contract awards are the following: California: $251,503 to **Fredericksen & Westbrook**, of Sacramento; $205,903 to **A. Teichert & Son, Inc.**, of Sacramento. Georgia: $205,930 to **M. J. Carroll Construction Co.**, of Leesburg, Fla. Illinois: $334,684 to **E. A. Meyer Construction Co.**, of Highland Park. Indiana: $248,135 to **W. L. Magaw**, Richmond; $504,214 to **O'Connor Construction Co., Inc.**, of Springfield, Ill. New York: $432,551 to **Frank Santo & Son**, of Binghamton; $235,440 to **D. W. Winkelman Co.**, of Syracuse; $274,757 to **John Bellardino, Inc.**, of Seneca Falls. Ohio: $204,931 to **Hollinger-Davidson Co.**, of Akron. Pennsylvania: $400,247 to **N. R. Corbisello**, of Binghamton, N. Y.; $443,642 to **C. W. Good**, of Lancaster; $329,181 to **Jos. Banks Construction Co.**, of Wilkes-Barre; $363,977 to **Frank Mark Construction Co.**, of Philadelphia. Texas: $376,949 to **Austin Bridge Co.**, of Dallas. **Great Lakes Dredge & Dock Co.**, of Chicago, Ill., received substructure contract for steel bridge in Illinois for $589,415. Contract for superstructure for railroad bridge over Columbia River in Washington went to **American Bridge Co.**, of Pittsburgh, Pa., for $499,319. In Brooklyn, N. Y., **C. F. Vachris**, local contractor, was awarded contract for 1½-mi. subway in connection with Atlantic Ave. grade crossing for $2,298,895.

AUGUST, 1940

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330 West 42nd St., New York

Construction Methods

A Pictorial Survey of Current Practice, Equipment and Materials

ROBERT K. TOMLIN, Editor — A. E. PAXTON, Manager

Editorial Staff: Vincent B. Smith, Paul Wooton (Washington), N. A. Bowers (San Francisco), Nelle Fitzgerald

A McGRAW-HILL PUBLICATION

The HOW of it

For the benefit of readers concerned with the practical application of method or equipment the following references are to articles or illustrations in this issue that tell:

How **HUGE WOODEN ARCH** of Lamella construction was built to form roof of armory. — p. 39

How **AIRPORT RUNWAYS** were paved with hot-mixed two-course asphalt. — p. 42

How **MECHANICAL SPREADERS** distributed hot asphaltic mix for airport runways. — p. 42

How **TRIPLE-AXLE TANDEM ROLLER** compacted asphalt paving. — p. 43

How **TALL STEEL TOWERS** carried floodlights for night baseball. — p. 45

How **TRAVELING SCAFFOLD** was employed to repair long concrete viaduct. — p. 46

How **HARNESS**, with rope attached, insured safety of workers on viaduct repair. — p. 48

How **TWELVE TUNNELS** were driven in rock to relocate railroad around dam. — p. 50

How **STEEL JUMBO** provided mounting for drills at three levels in rock tunnel. — p. 51

How **STEEL SUPPORTS** protected top heading of rock tunnel. — p. 53

How **PULLING AND LOADING** of stumps was done by diesel tractor equipped with winch. — p. 54

How **TENSION INDICATOR** showed amount of pull on lifting line. — p. 54

How **PROFILOMETER** made continuous graph of surface smoothness of concrete pavement. — p. 55

How **FRAMED TIMBER FALSEWORK** was erected with aid of split-ring connectors. — p. 55

How **VIBRATORY PAN FEEDERS** controlled quantities of aggregate at asphalt plant. — p. 55

How **BULLDOZER BLADE** on motor-grader cleared, leveled and cut side slopes and ditches on road job. — p. 55

How **FOUR-CYLINDER CAISSONS** for bridge piers were sunk by compressed air methods. — p. 58

How **ROAD BUILDING METHODS** were applied to airport expansion. — p. 60

How **WOOD PANEL FORMS** for concrete dams were designed and used. — p. 62

How **ALUMINUM A-FRAME** and ratchet hoist handled panel forms. — p. 62

How **FOUR MAJOR BRIDGE TYPES** were utilized for grade separation and drainage on turnpike project. — p. 64

How **ROCK SPREADER** faced earth dam slope. — p. 69

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THE JOB JESTER

CARTOONS DRAWN FOR CONSTRUCTION METHODS



"Oh, that's all right—these are old shoes!"



"You don't happen to know where I can get a drink of water?"



"Hey, you! There's a swell opening for a first class structural worker on the 17th floor."

CONSTRUCTION PREPAREDNESS

NAVY'S SHIP-MODEL TESTING BASIN READY SIX MONTHS AHEAD OF SCHEDULE



15,000 BARRELS of 'Incor' 24-Hour Cement, used in concrete roof of U. S. Navy Ship-Model Testing Basin, Carderock, Md., aided in completion six months ahead of contract date. About 60,000 bbl. of Lone Star Cement were also used.

. . . TYPICAL OF TIME-SAVING ON BUILDINGS, BRIDGES, HIGHWAYS— THROUGH GOOD JOB PLANNING AND USE OF 'INCOR' 24-HOUR CEMENT

VITAL months saved . . . new plants in production weeks sooner . . . through good job planning and the use of 'Incor' 24-Hour Cement. Forms are filled with 'Incor' concrete one day, stripped the next, saving four to five days on each pour. Immediate form re-use cuts costs—fewer form-sets needed. And earlier completion reduces overhead expense.

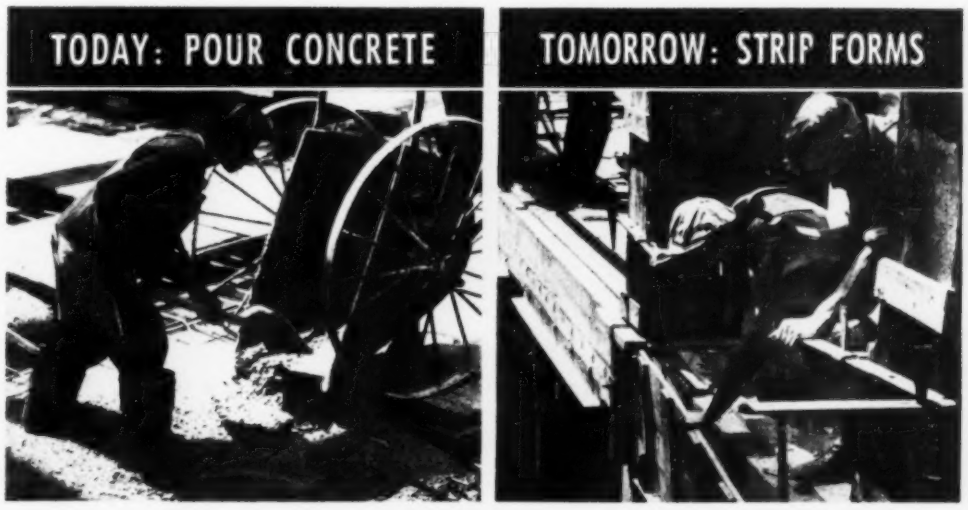
Navy Engineers, recognizing these economies, specified high early strength cement for the roof of the new Ship-Model Testing Basin (left). 'Incor' strengths exceeded form-removal specifications—helped Turner Construction Co., New York, general contractor, complete the structure six months ahead of contract date.

'Incor's dependable 24-hour service strength saves time, cuts costs . . . and 'Incor' quality assures long-time durability. An 'Incor'* engineer will be glad to confer with you on concrete problems. Lone Star Cement Corporation, 342 Madison Avenue, New York. *Reg. U. S. Pat. Off.

USE 'INCOR', FOR MAXIMUM SPEED AT MINIMUM COST

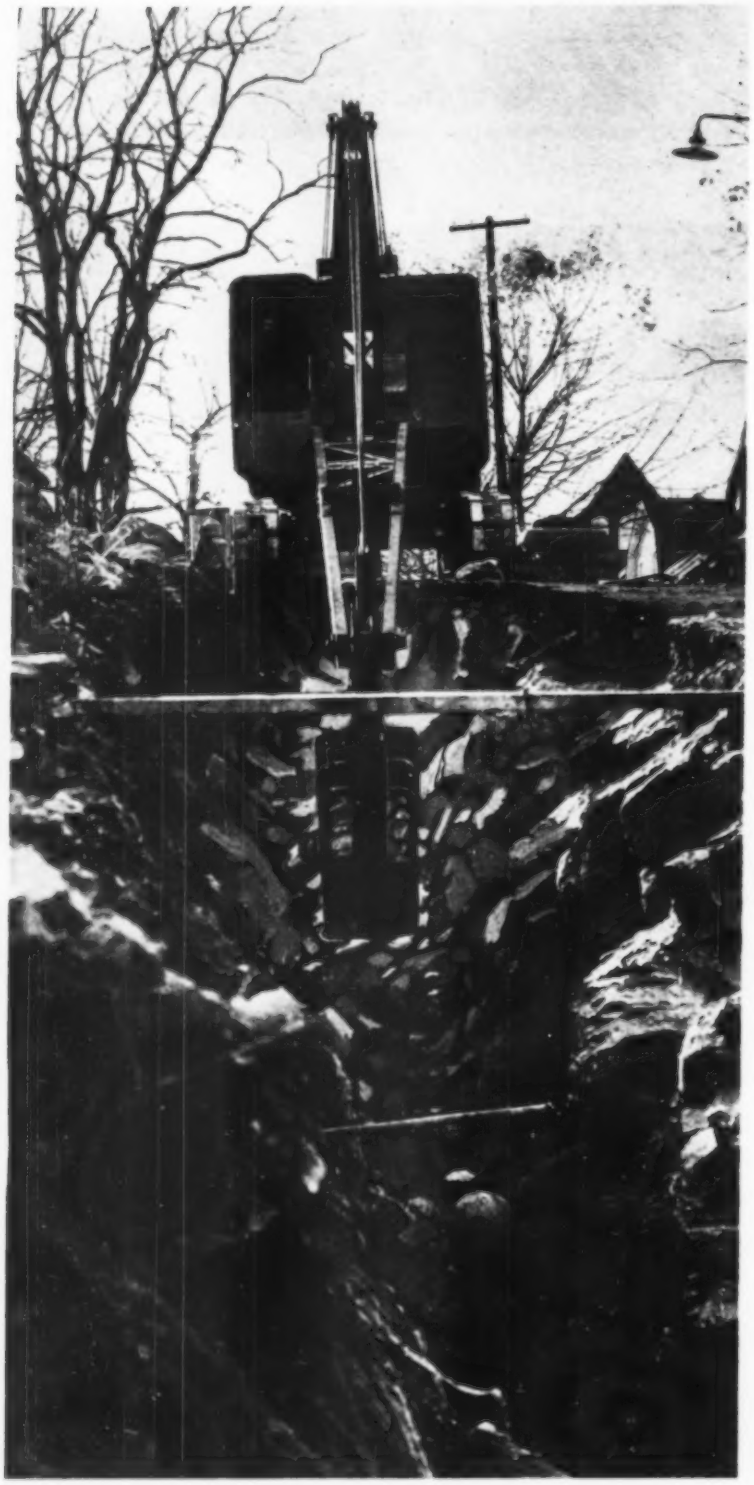


13 YEARS' performance: Over 10-million barrels of 'Incor' have been used. That means service and performance . . . based on the quality and uniformity of this *first* high early strength Portland cement.



LONE STAR CEMENT CORPORATION

MAKERS OF LONE STAR CEMENT • • • 'INCOR' 24-HOUR CEMENT



The Model 45, heavy duty ¾ yard Trench-hoe shown in this photo is but one of 12 sizes of fast, powerful, easy-to-operate convertible shovels made in capacities ranging from ⅜ to 1½ yards. All are fully convertible without machinery change and follow heavy-duty design and construction throughout. Watch a BAY CITY work and you will want the same smooth performance on your next job.

ROCK EXCAVATION

EXPERIENCED contractors know that rock excavation under any condition is no "bed of roses"—they know too, that trench-hoe operation is the most severe assignment you can give a machine. Combine these on a trench cut through hard New England rock and you have a real test of endurance, stamina and power.

Yet, this ¾ yard BAY CITY took the job in its stride and came back for more. Shocks, stresses and strains—bending and twisting. They are all present. To survive this kind of punishment a machine must be built to rugged, sturdy specifications—the kind of construction found in the BAY CITY.

Here are a few of the important reasons why a BAY CITY will give outstanding performance on jobs like these. The long, wide spread crawlers give an excess of stability. The unit cast alloy steel bases, totally heat treated, provide added strength and have the ability to absorb shock and vibration. The big power plant delivers maximum horse power to bucket cutting lip through quiet, smooth running helical gears. Tandem drums, mounted in ball bearings provide easy, free running machinery and booster operated clutches eliminate operator fatigue.

You can depend on a BAY CITY to come through on tough assignments — Want additional details? Then write for your copy of our 32-page illustrated Catalog H-2.

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SHOVELS • CRANES • DRAGLINES • TRENCH-HOES • SKIMMERS

Ralph Myers moves ahead...



with

Bottom-Dump EUCLIDS

Moving ahead » » »

During the past year Ralph Myers Construction Company moved ahead on the following contracts with Bottom-Dump EUCLIDS:

	Cu. Yds.
Ceredo, W. Va.—flood wall and earth levee .	856,000
Kenova, W. Va.—flood wall and earth levee .	554,000
Toby Creek, Penna.—intake works	350,000
Zanesville, Ohio—Route 40 road job	1,127,000
Westmoreland County, Penna.—road job . . .	225,000
Armstrong County, Penna.—road job	410,000
Golconda, Illinois—earth levee	422,000

Since 1935 Ralph Myers Construction Company has found Bottom-Dump EUCLIDS to be a dependable mainstay of its hauling equipment . . . . consequently, when additional equipment was needed, the unqualified choice was for EUCLIDS—time-proven for dependability, low maintenance cost, speedy production, and adaptability to a wide range of different sizes and types of jobs . . . .

Last year this growing Company added nine 13-Yard Bottom-Dump EUCLIDS to its fleet—this year it purchased six more . . . .

What better proof is there that you too should investigate Bottom-Dump EUCLIDS?





THE EUCLID ROAD MACHINERY CO.
CLEVELAND, OHIO U. S. A.

EUCLID
THE PIONEER

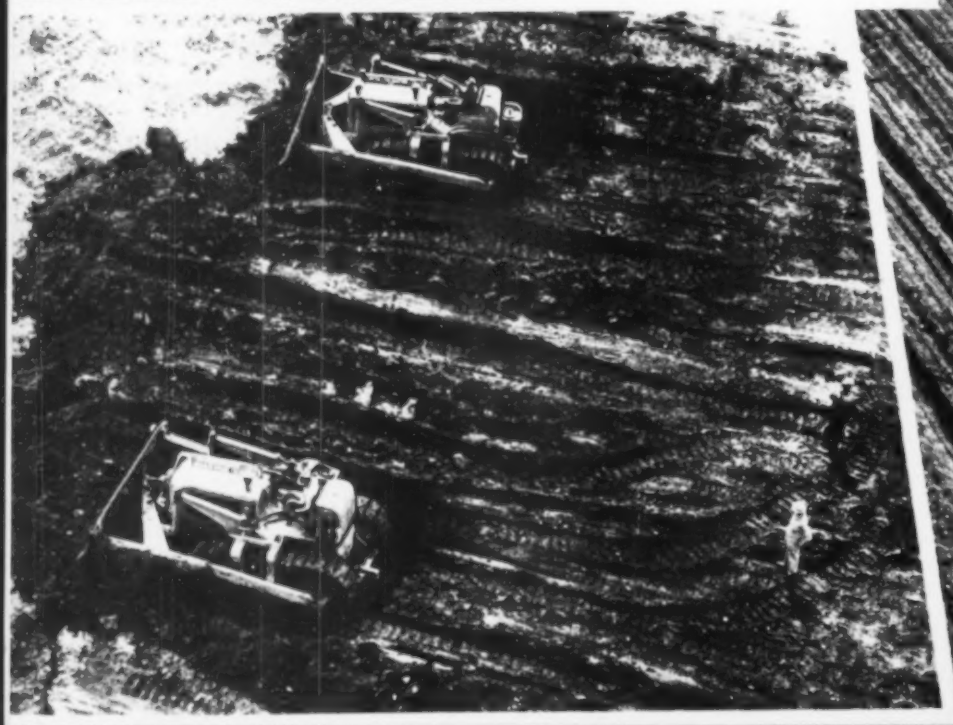
Latest News on the Washington National Airport—



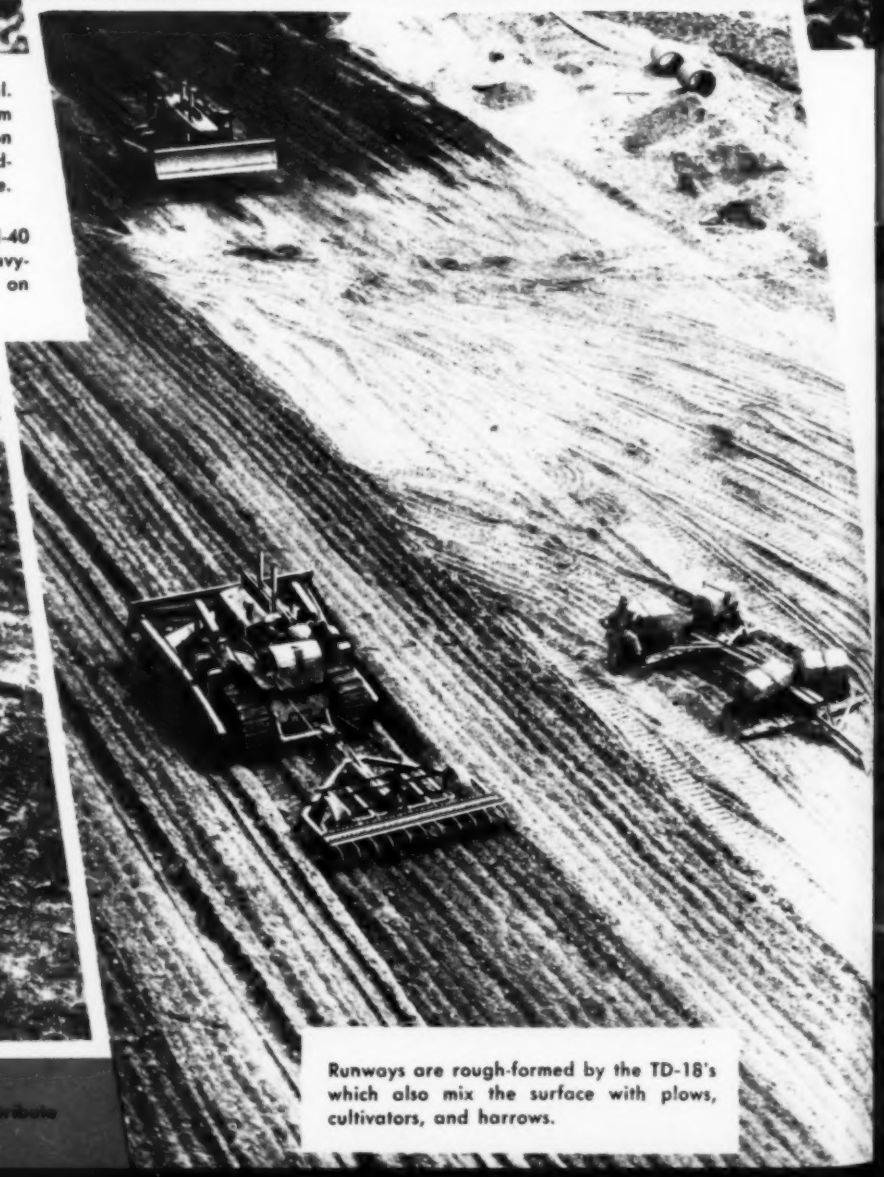


Above: 'Dozing the fill material. An unusual rock formation from the river bed makes it tough on tracks, but the TD-18's are standing the punishment in good shape.

Left: One of the International I-40 Wheel Tractors pulling a heavy-duty cultivator, mixing gravel on a runway.



Above: The International TD-18 Diesels turn, mix, and dry the fill material. They also distribute and re-distribute it around the airport and into the runway bases.



Runways are rough-formed by the TD-18's which also mix the surface with plows, cultivators, and harrows.

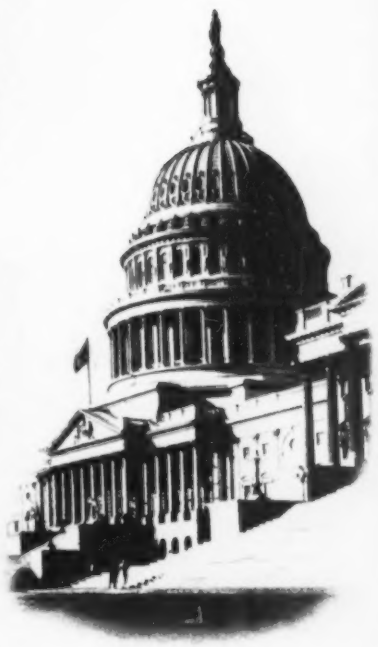
24 International TD-18's are Speeding it to Completion!

AMERICA'S largest airport and terminal, at Gravelly Point, Va., serving the nation's capital, is now being rushed to completion with the aid of 24 International TD-18 Diesel Trac-TracTors. These powerful crawlers have taken over this tremendous earth-moving job as a result of the outstanding performance of one of these units which went on the job a year ago.

When the new TD-18 hit the market early last year, the demand far exceeded the supply. As soon as the Northern Virginia Construction Co., Alexandria, managed to get one, they put it to work on the Washington Airport. Right from the start, the TD-18 became the most popular tractor on the field. Everyone wanted to use it. Unqualified statements made by those who got it, labeled the TD-18 as the *best tractor on the field regardless of size.*

With all these men *the reputation of* this great tractor *was made.* It was natural, then, for 12 more TD-18's to get the call in February. Today there's a total of 24, owned by the Northern Virginia Construction Co.; L. B. Smith, Harrisburg; and the Capital Excavating Co., Highway Engineering Co., and Morauer and Harzell, Washington. In addition, there are 2 International I-40 wheel-type tractors on the job.

There are many reasons back of the amazing success of the International TD-18 Diesel. *It had to be plenty good on the Washington Airport*—as on *every* job, because it's been under the severest scrutiny. Wherever it works it comes through with flying colors. It *has everything* crawler-tractor users have wanted for years. And its three new smaller brothers are also carrying on the good work. For complete information on these four International Diesel TracTracTors, see the International industrial power dealer or Company branch near you.



INTERNATIONAL HARVESTER COMPANY
(INCORPORATED)
180 North Michigan Avenue Chicago, Illinois



Four TD-18's working on a section of the field. Fleets work in conjunction like this, handling the wet and dry fill.

INTERNATIONAL Industrial Power

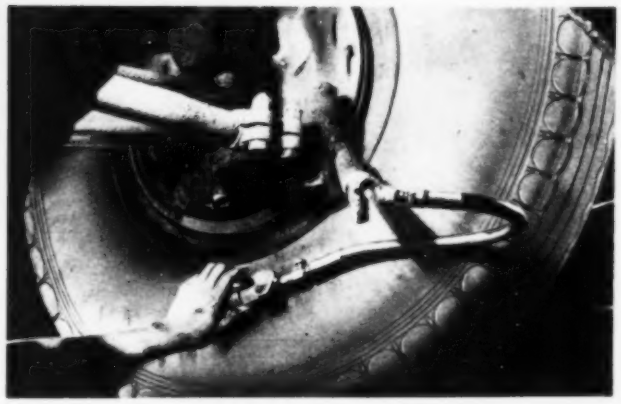
Bearing Protection . . .

Under Loads Like This



25 CU. YD. CARRY-ALL, built by Wooldridge Mfg. Co. at Sunnyvale, California. All heavy equipment here is lubricated with *Texaco Marfak*. This selection is based upon their experience that only Marfak meets their needs.

EASIER STEERING is assured when the steering connections and wheel bearings are lubricated with *Texaco Marfak*. This lubricant protects your investment, by protecting parts *twice as long* as ordinary grease.



YOU CAN haul the heaviest loads over the roughest terrain, in the hottest weather . . . assured of full protection . . . when you use *Texaco Marfak*. *Texaco Marfak* protects wheel bearings, steering connections and chassis parts *twice* as long as ordinary grease.

Containing high grade heavy-bodied mineral oil, *Texaco Marfak* provides a tough film equal to the heaviest loads. Marfak is tough, stringy, fibre free.

Texaco Marfak seals out dirt, mud, road water. Does not separate, leak out, to get on your brake lining, because it maintains its original consistency at the outer edges of the bearing while lubricating effectively within.

Trained automotive engineers will gladly cooperate in making savings with *Texaco Marfak* in your heaviest equipment. Phone the nearest of more than 2300 warehousing points in the 48 States, or write:

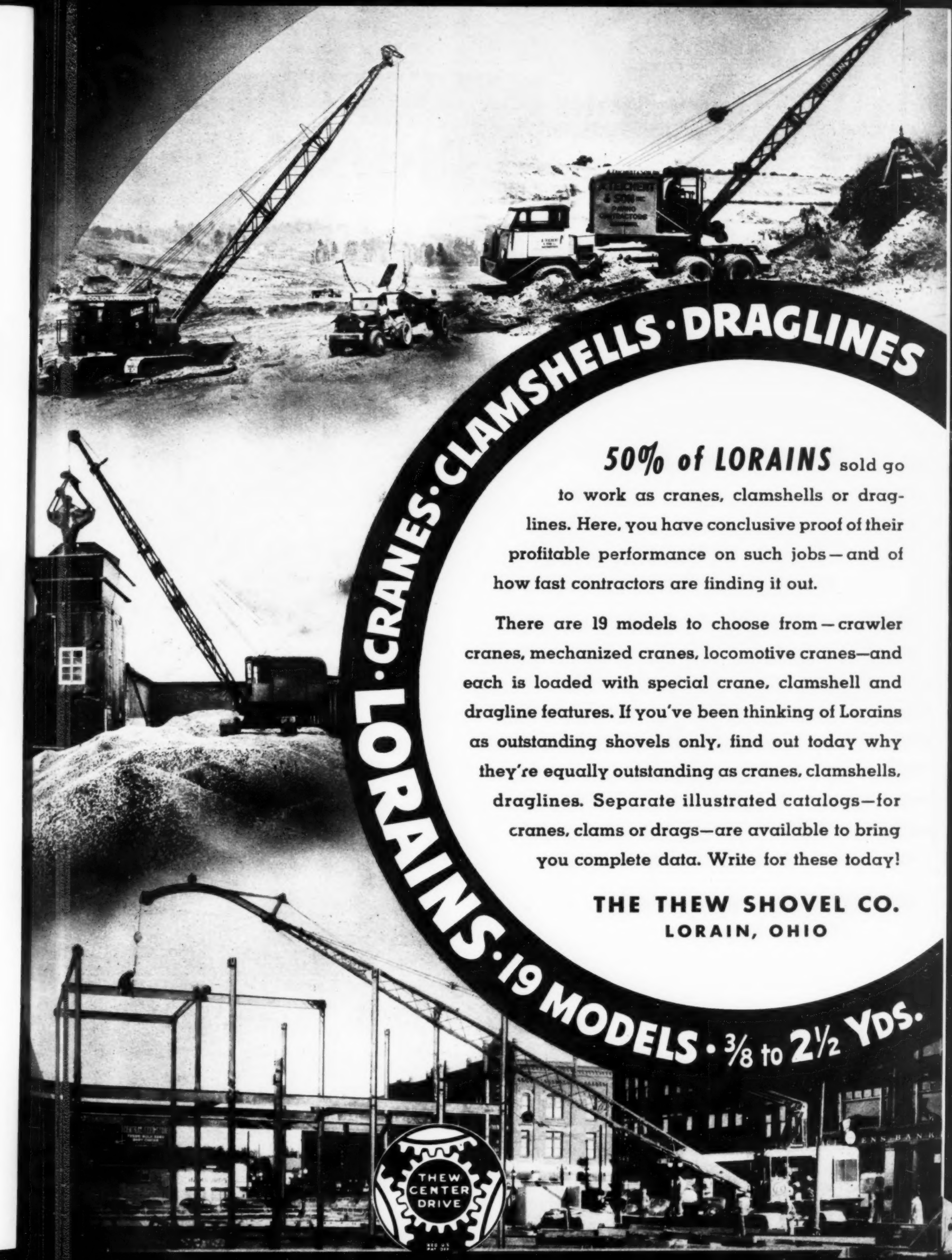
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50% of LORAINS sold go to work as cranes, clamshells or draglines. Here, you have conclusive proof of their profitable performance on such jobs—and of how fast contractors are finding it out.

There are 19 models to choose from—crawler cranes, mechanized cranes, locomotive cranes—and each is loaded with special crane, clamshell and dragline features. If you've been thinking of Lorains as outstanding shovels only, find out today why they're equally outstanding as cranes, clamshells, draglines. Separate illustrated catalogs—for cranes, clams or drags—are available to bring you complete data. Write for these today!

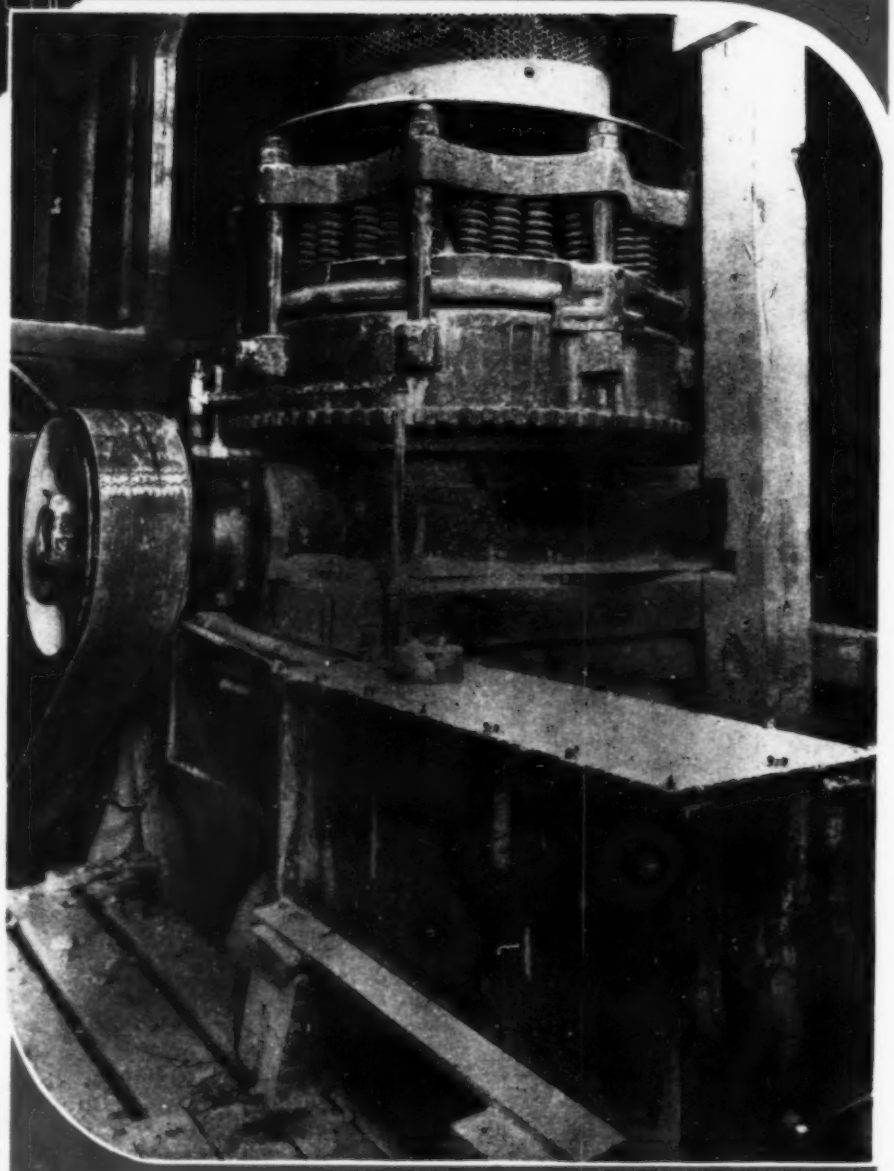
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LORAIN, OHIO



COMPANY PLANT . . . . . .

TELSMITH GYRASPHERE

produces 120 tons per hour of minus 1½" stone!



Wide experience . . . gained in operating ten quarries in Kentucky . . . has made the Kentucky Stone Company of Louisville very critical of quarry plant equipment.

For their Tyrone Plant* they selected this No. 48 Telsmith Gyrasphere because they wanted to get finer crushing, a wider range of sizes as well as greater tonnage. Are they getting it? *They are.*

120 tons an hour of 1½" and down!

And the Gyrasphere would do better still, if the primary breaker, and the two vertical skips that hoist the rock from where it is mined underground, could dish it up any faster. With its unregulated choke feed this Gyrasphere sure can take it—and handle it—with less trouble, less power and less up-keep.

And why not—it's a rugged, high-speed, super secondary crusher—with every modern feature of design. Spherical head! Double wedge crushing action! Roller thrust bearings! Spring relief! Effective sealing and lubrication! Furnished with interchangeable coarse or fine crushing concaves, you can get the sizes you want—1½" to ⅜", or ⅜" to ⅛". And you'll get better, more cubical aggregate, too. *Bulletin Y-10* tells you why and how. *Get one.*

* *Plants at Irvington and at Russellville have also been modernized with Telsmith crushing and screening equipment.*

Y-2-40

TELSMITH

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211 W. Wacker Drive Chicago, Ill.

Brandeis M. & S. Co. Louisville, Ky.

713 Commercial Trust Bldg. Philadelphia, Pa.

Roanoke Trac. & Equip. Co. Roanoke, Va.

Only one week old...



BUT TOUGH ENOUGH TO CARRY TONS!



Two Days after Atlas High-Early concrete was placed, workmen stripped the forms. And but one week after placement, the concrete carried the load of truck crane for erecting steel frame on second floor.

Saved two to three weeks' time—Atlas High-Early concrete takes load of truck crane and steel one week after placement

THREE MONTHS—that's all the time the contractor had left to finish this job. And because completion on schedule was essential, Atlas High-Early cement was specified—a cement that gains working strength in much less time than normal portland cement.

Result? The contractor reported that "they stripped forms in two days as against four to five days when using normal portland cement." And in only one week—instead of the two or three weeks required with normal portland cement—the concrete columns and floor were ready to take the heavy load of a truck crane required for erection of the steel frame for the second floor.

You also may save time, and on many jobs save money, by using Atlas High-Early cement. Give it a trial on your next job. Often earlier use of concrete, reduced cost for protection and curing, and lower form costs more than pay for the slightly higher cost of Atlas High-Early cement. Universal Atlas Cement Co. (United States Steel Corp. Subsidiary), Chrysler Bldg., N.Y.C.

CM-H-18

ATLAS HIGH-EARLY CEMENT

A UNIVERSAL ATLAS PRODUCT



HAULS AT TRUCK SPEEDS — Model C Tournapull speeding 11 heaped yards to the fill at 14 m.p.h. This Tournapull is one of four now working on a highway job in Upper Michigan on hauls of one-half to three miles one way.



New—

FASTER WAY OF EARTH

EASY, SAFE, SIMPLE TO OPERATE—The same Power Control Unit that makes Carryall loading and spreading so simple with tractors is used on Tournapulls. Shifting and steering differs but little from tractor operation. Rig shown here is working on a dam in Ontario, Canada.



LOW-COST YARDAGE FAST—Despite frequent rains, these four Tournapulls at Pinopolis Dam moved approximately 219,000 pay yards in 49 working days over hauls ranging from one to two and three-quarters miles one way.



TAKES UP WHERE TRACTORS LEAVE OFF..EXTENDS

Tournapulls . . . newest thing in earthmoving . . . are designed to give you one-man earthmoving on long hauls. They combine in one fast-moving, self-propelled unit all the advantages of the job-proved LeTourneau Carryall Scraper and the world famous "Caterpillar" Diesel engine. They utilize the LeTourneau self-loading feature, which with a pusher eliminates the need for special loading equipment and cuts out waiting at the shovel. They

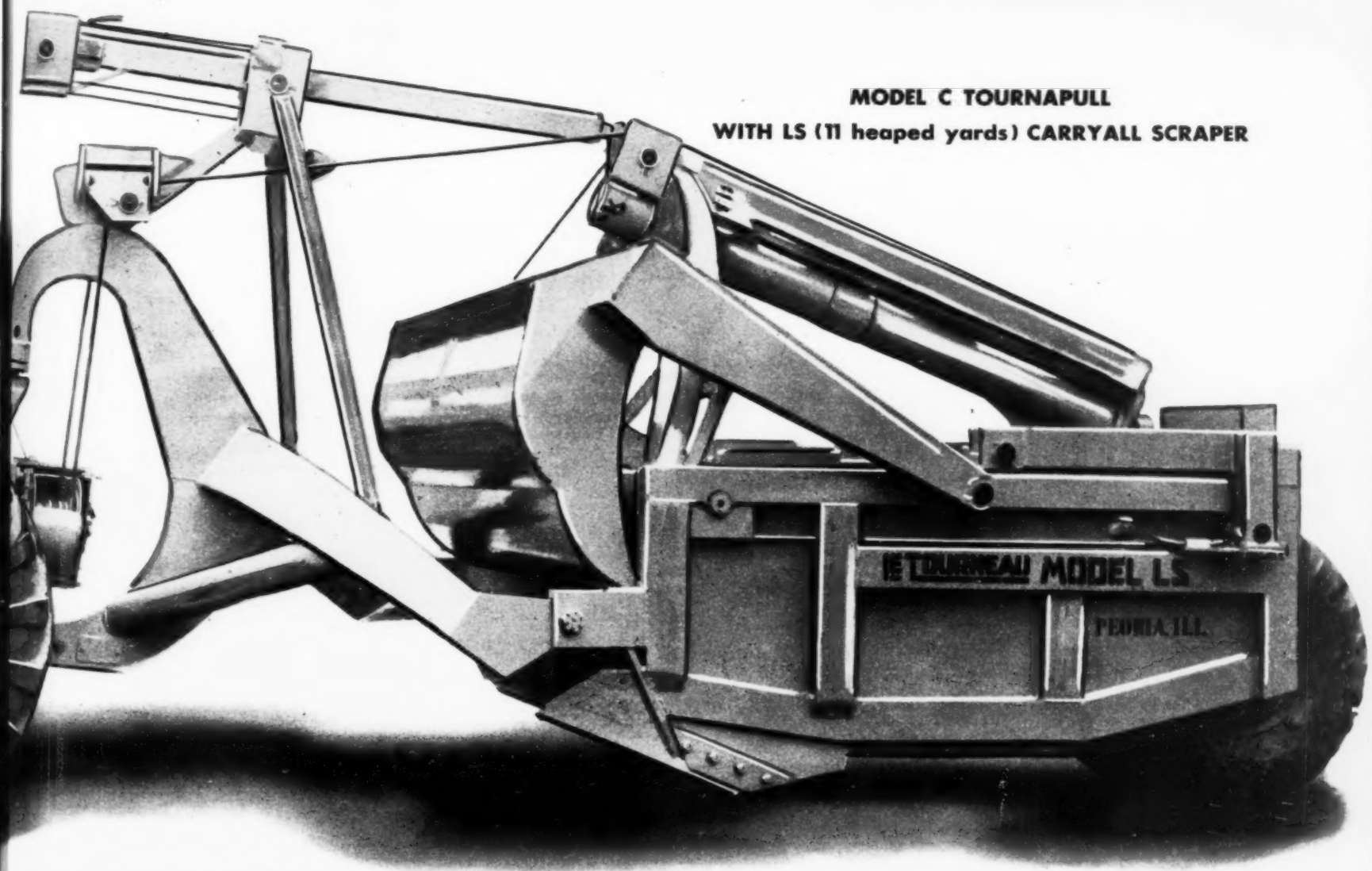
LE TOU

PEORIA, ILLINO

For Lowest Net Cost Per Yard... CAR

CONTROL UNITS, DRAG SCRAPERS, PUSHDOZERS, SHEEP'S FO

TOURNATRAILERS*.



MOVING..*THE TOURNAPULL METHOD*

LeTOURNEAU CARRYALL SAVINGS TO LONG HAULS

haul tractor-size loads at truck speeds and spread their own loads, thus save you the need for spreading tools at the fill. No other equipment now on the market can deliver so much yardage so fast or so cheaply.

See for yourself what Tournapulls can do. Ask your LeTourneau dealer to show you how they extend Carryall savings to long hauls. See him NOW to assure yourself early delivery.

TOURNAPULL DESIGN INCREASES TRACTION & MANEUVERABILITY

The Tournapull transmits its power and steers through two extra-large drive wheels. Because these two drive wheels have (1) an unusually large tire area on the ground, (2) full engine power and weight, plus a large share of the trailed unit weight, concentrated on them, you get far greater traction than is possible with conventional 4-wheel pulling units of the same power. Result: you're able to go where trucks and other tractor-trucks cannot, and same time load and haul more yardage. Extensive job use shows low center of gravity and extra large tires enable Tournapulls to travel consistently over uneven, rutted roads at higher speeds than trucks. They're short turning, too . . . maneuver in and out of tight spots at surprising speed.

Job Proved on Two Coasts

Tournapulls have been in operation two full years. In the experimental stages, 15 Tournapulls, working 3 shifts daily, 6 days a week, moved more than 4,000,000 cubic yards at Hansen Dam on the Pacific Coast. On hauls averaging 4,500 feet one way, these rigs travelled fully loaded (30 heaped yards) at an average speed of 12 m.p.h.

Recently on a 3-mile haul at Pinopolis Dam, South Carolina, 4 Tournapulls, working two 8-hour shifts, averaged better than 200 miles each per day, hauling pay loads of 20 to 23 yards. That's moving dirt fast!

MADE IN THREE SIZES

Tournapulls are made in 3 sizes, with the following capacities and speeds:

Model A with NU	Carryall — 45	heaped	yards — 1.8	to	25.7	m.p.h.
Model A with N	Carryall — 33	heaped	yards — 1.8	to	25.7	m.p.h.
Model A with RU	Carryall — 30	heaped	yards — 1.8	to	25.7	m.p.h.
Model B with LU	Carryall — 19	heaped	yards — 2.6	to	19	m.p.h.
Model C with LS	Carryall — 11	heaped	yards — 2.4	to	14.3	m.p.h.

RNEAU

STOCKTON, CALIFORNIA

SCRAPERS, ANGLEDOZERS*, BULLDOZERS, ROOTERS*, POWER LLERS, CRANES, BUGGIES*, TREEDOZERS, TOURNAPULLS*,



Part of the bituminous distributing equipment of the Truman L. Flatt Co. fleet, Springfield, Ill. Mr. Flatt figures that Standard Red Crown, Iso-Vis Motor Oil and Paul Rickcords, Standard Automotive Engineer, have helped him reduce fleet operating costs 30% in one year.

CONTRACTOR SAVES 30% OF OPERATING COSTS

After one year's experience with Standard Automotive Engineering Service, here's what Truman L. Flatt, road contractor in Springfield, Illinois, has to say:

> "I am very well pleased with the savings shown in fuel and lubricating costs, and this, together with the services performed by your Automotive Engineer, has enabled me to reduce my operating cost as much as thirty per cent in the last year."

It certainly seems that Mr. Flatt found this Engineering Service helpful. Why don't you join him and hundreds of other construction equipment operators and find out just how helpful this service can be.



HERE'S HOW THESE ENGINEERS WORK

There's no mystery about the service these engineers render. The methods they use and the equipment they have for checking fleet equipment are familiar to many fleet operators. They do have one advantage. They know automotive fuels and lubricants and how their products should perform under various conditions. When performance isn't up to par they have instruments for finding out why. It's as simple as that—but it works!

MISSOURI COUNTY CUTS GREASE COSTS ONE-THIRD

Gasoline consumption is not the only interest of a Standard Oil Engineer. For instance, the road maintenance equipment shown above is typical of that operated by Knox County, Mo. Grease consumption is an important item in the cost of operation. A Standard Automotive Engineer suggested a test of Standard Gear Lubricant. The test showed that Standard Gear Lubricant gave *all the advantage* of the grease formerly used at *one-third less*.

HERE'S WHERE YOU'LL FIND YOUR STANDARD AUTOMOTIVE ENGINEER

Billings, Montana
Chicago, Illinois
Davenport, Iowa
Decatur, Illinois
Denver, Colorado
Des Moines, Iowa
Detroit, Michigan
Duluth, Minnesota
Evansville, Indiana
Fargo, North Dakota
Grand Rapids, Michigan
Green Bay, Wisconsin
Huron, South Dakota
Indianapolis, Indiana
Joliet, Illinois
Kansas City, Missouri
LaCrosse, Wisconsin
Mankato, Minnesota
Mason City, Iowa
Milwaukee, Wisconsin
Minneapolis, Minn.
Peoria, Illinois
Quincy, Illinois
Saginaw, Michigan
St. Joseph, Missouri
St. Louis, Missouri
South Bend, Indiana
Wichita, Kansas

Why not have one of these engineers explain fully just what he does to help make these savings. A card to your local Standard Oil (Indiana) office or to 910 S. Michigan Avenue, Chicago, Illinois, will reach the engineer you want. In Nebraska, call or write Standard Oil Company of Nebraska at Omaha. Just say, "We'd like to have your Standard Automotive Engineer call."

STANDARD OIL COMPANY (INDIANA)

LUBRICATION ENGINEERING THE RIGHT LUBRICANT • PROPERLY APPLIED TO REDUCE COSTS

NORTHWESTS WERE BORN TO ROCK WORK!

NORTHWESTS are built up to the maximum job to be done! They are born to rock work — no need to wean them! It is jobs like this that have made Pinnell & Pfost of Ripley, W. Va. buy a fifth Northwest. With a real Rock Shovel they won't have to worry about output in dirt.

The next time you are in the market for a shovel, remember that one out of every three Northwests sold is a repeat order — and remember Northwest's reputation as a Rock Shovel — then ask us about the Northwest advantages that made this reputation possible.

NORTHWEST ENGINEERING COMPANY
1728 Steger Bldg. 28 E. Jackson Blvd.
Chicago, Illinois

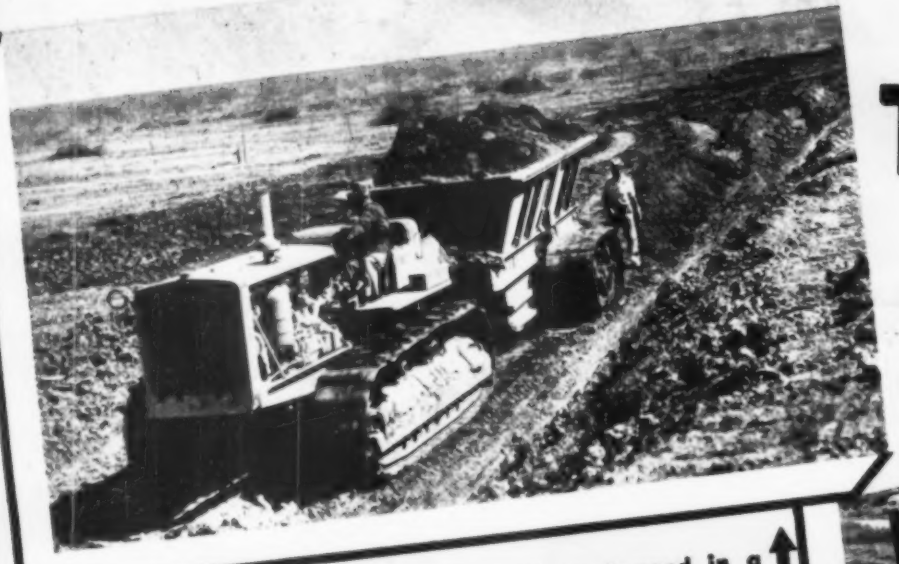
This makes five for PINNELL *and* PFOST *Ripley, W.Va.*



IF IT'S A REAL ROCK SHOVEL — YOU'LL NEVER HAVE TO WORRY ABOUT OUTPUT IN DIRT!

MASTER

TO EVERY

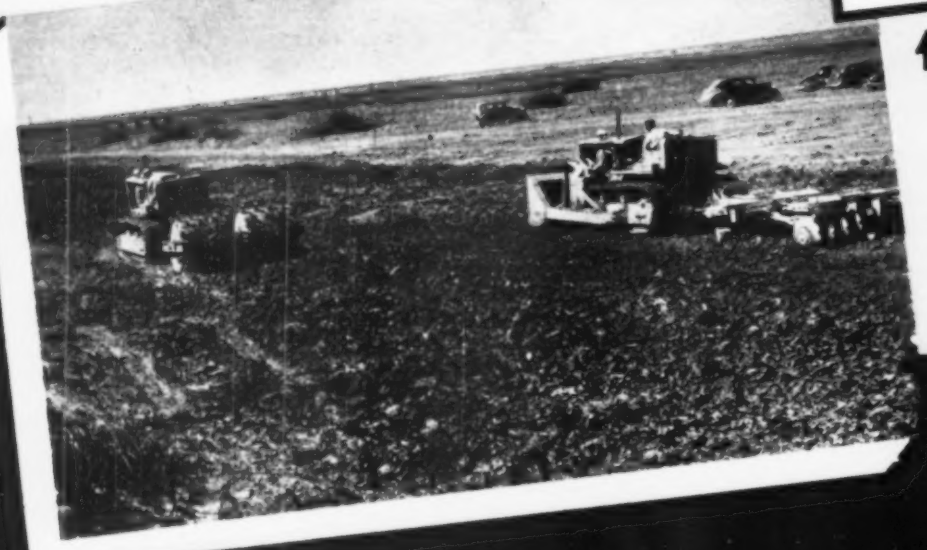


End of haul — dumping at the fill. The earth is dumped in a continuous windrow to enable the 'dozer to spread in one pass.

One "Caterpillar" Diesel D8 leveling wagon fills with buildozer and at same time pulling disc for better compacting. Another "Caterpillar" Diesel D8 pulls sheepsfoot tamper.



Pumping water with "Caterpillar" Diesel power take-off, to wet down dirt for ready handling. On 6-foot lift from drainage ditch, 6-inch pump moves 1200 gallons per minute.



"Caterpillar" Diesel D8 Tractor and Athey wagon combinations hauling material loaded by a 3-yard dragline. Average load, 14.4 yards. On 1700-foot haul, unit averages 5 trips per hour. (No time wasted here . . . as a loaded unit moves on, another is coming up under the dragline.)

CATERPILLAR

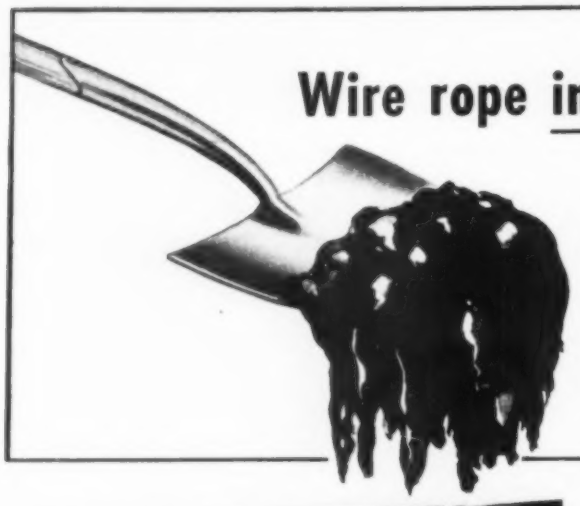
REG. U.S. PAT. OFF.

TRACK-TYPE TRACTORS • ROAD MACHINERY • DIESEL ENGINES AND ELECTRIC SETS

KEY JOB

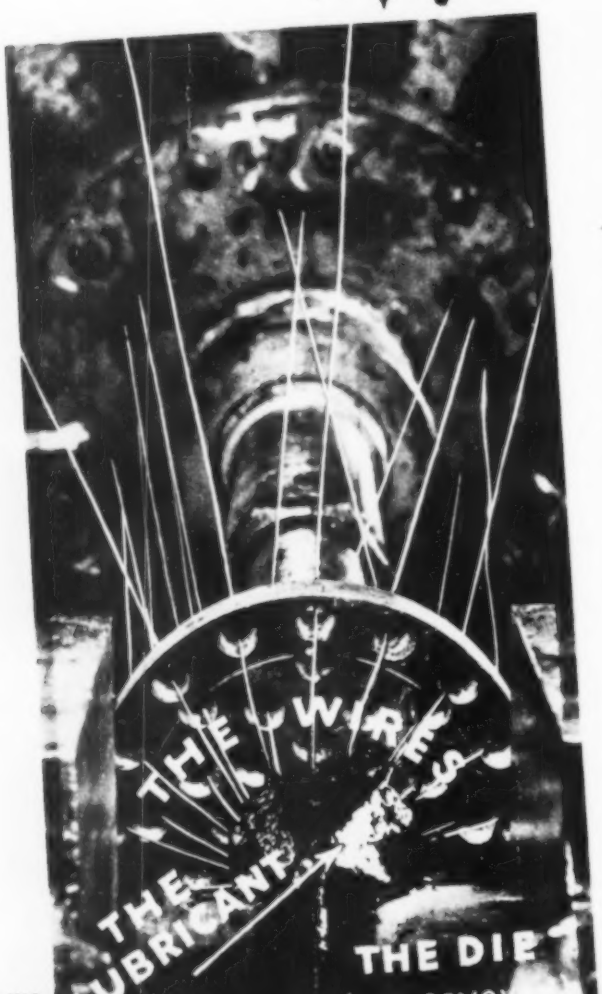


We take you to the International Boundary Commission project, near Rio Hondo, Texas. Master factor in the rapid progress of this notable undertaking is a fleet of "Caterpillar" Diesel Tractors: Their power, traction and maneuverability afford wide application to various types of equipment — giving them the versatility to get in on practically every kind of job. . . . They spot wagons under the dragline — run huge loads of pay-dirt over rough or soft haul-roads (or no roads at all) — dump them — spread them with bulldozer attachment — pump water from drainage ditch to wet down dusty fills — pull discs and tampers for thorough compaction. Rain and soggy ground conditions do not stop these powerful broad-tracked, sure-gripping motive power-plants from hauling, dumping and leveling heavy, water-logged earth and clay. • Through perfect co-ordination of tasks and implements, the work goes on *CONTINUOUSLY* — at a steady, time-saving pace. . . . A fine example of today's way of handling big contracts toward quick completion and maximum profit! CATERPILLAR TRACTOR CO., PEORIA, ILLINOIS.



Wire rope internally protected by a lubricant that

sticks like molasses in January



A moment before wires enter the stranding die they pass through a thick "holeless doughnut" of special Macwhyte lubrication. Every wire is covered with a thick, heavy blanket—every space in the strand is completely filled. This tenacious lubricant sticks like molasses in January—and prolongs the life of the rope.

It's pressure-fed around EVERY WIRE and fills all spaces . . . it battles abrasion, corrosion and internal friction

HEAVY...VISCOUS...TENACIOUS...that's why the special lubrication force-fed around every wire in every strand of Macwhyte Wire Rope is an enemy of wire rope troubles.

Extra good, extra long-lasting lubrication like this is needed in wire rope—because every wire presents a bearing surface which requires lubrication. Most of these surfaces are inside your rope where you can't see them. Proper internal lubrication is essential to safe and economical service.

Macwhyte lubrication, force-fed into every strand, withstands all atmospheric conditions—extreme cold or intense heat—without flaking or melting. This protective coat of heavy armor guards every wire and strand against destructive elements—and reduces internal friction to a minimum.

This special lubricant is only one of many reasons why Macwhyte WHYTE STRAND PREformed gives outstanding performance on the job. Use this rope next time . . . there's a size and construction *specially* designed for your equipment.

MACWHYTE COMPANY, home offices, Kenosha, Wisconsin. Manufacturers of rope wire—left-and-right lay braided wire rope slings—Monel Metal wire rope—Stainless Steel wire rope—Aircraft cables and tie-rods, "Safe-Lock" Swaged Terminals—and wire ropes to meet every need. · New York · Pittsburgh · Chicago Ft. Worth · Portland · Seattle · San Francisco · (Distributors throughout the U. S. A.)

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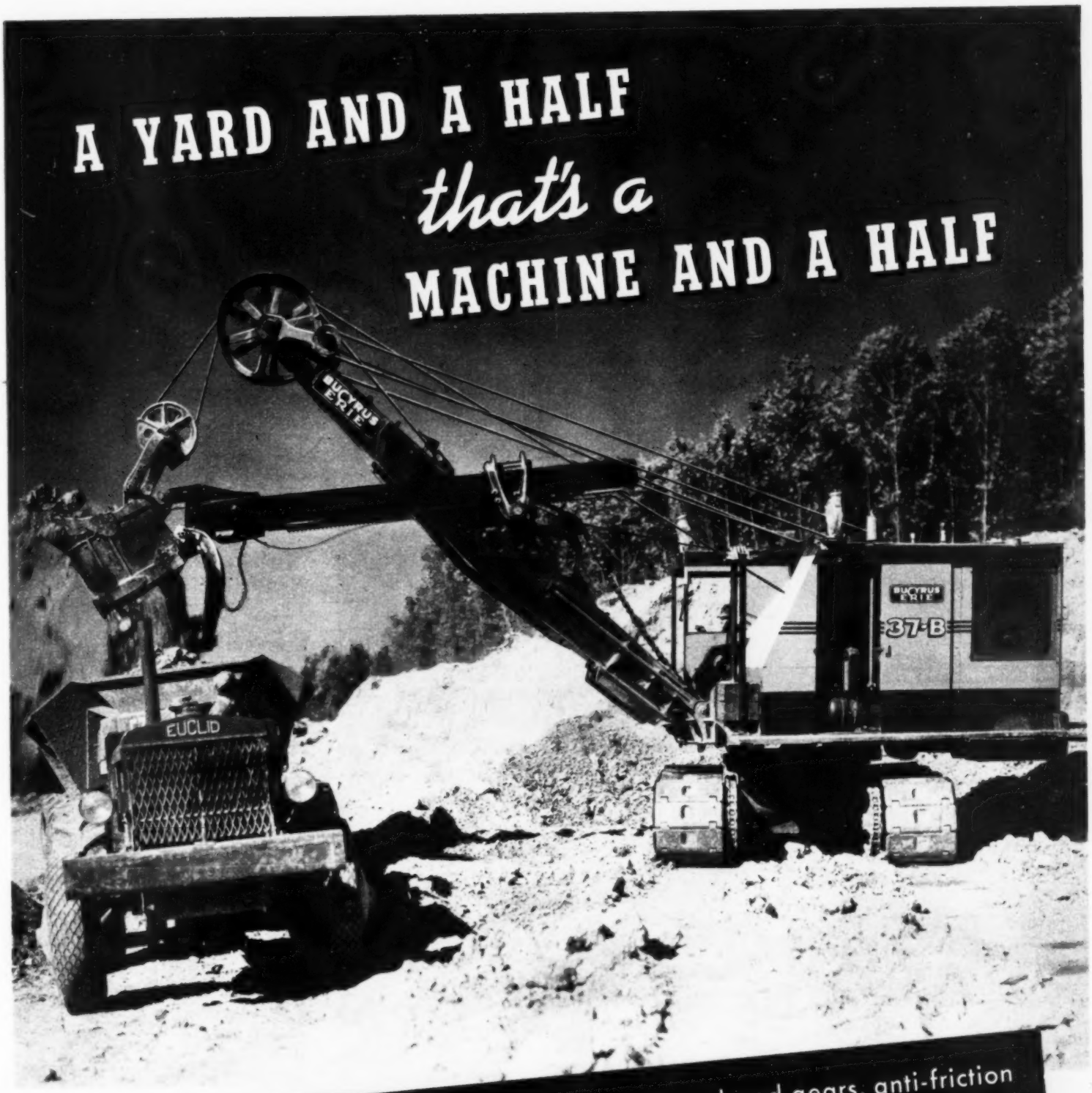
MACWHYTE

Whyte Strand - PREformed

WIRE ROPE

LABORATORY TESTED—FIELD PROVED WITH THE INTERNAL LUBRICATION

A YARD AND A HALF *that's a* MACHINE AND A HALF



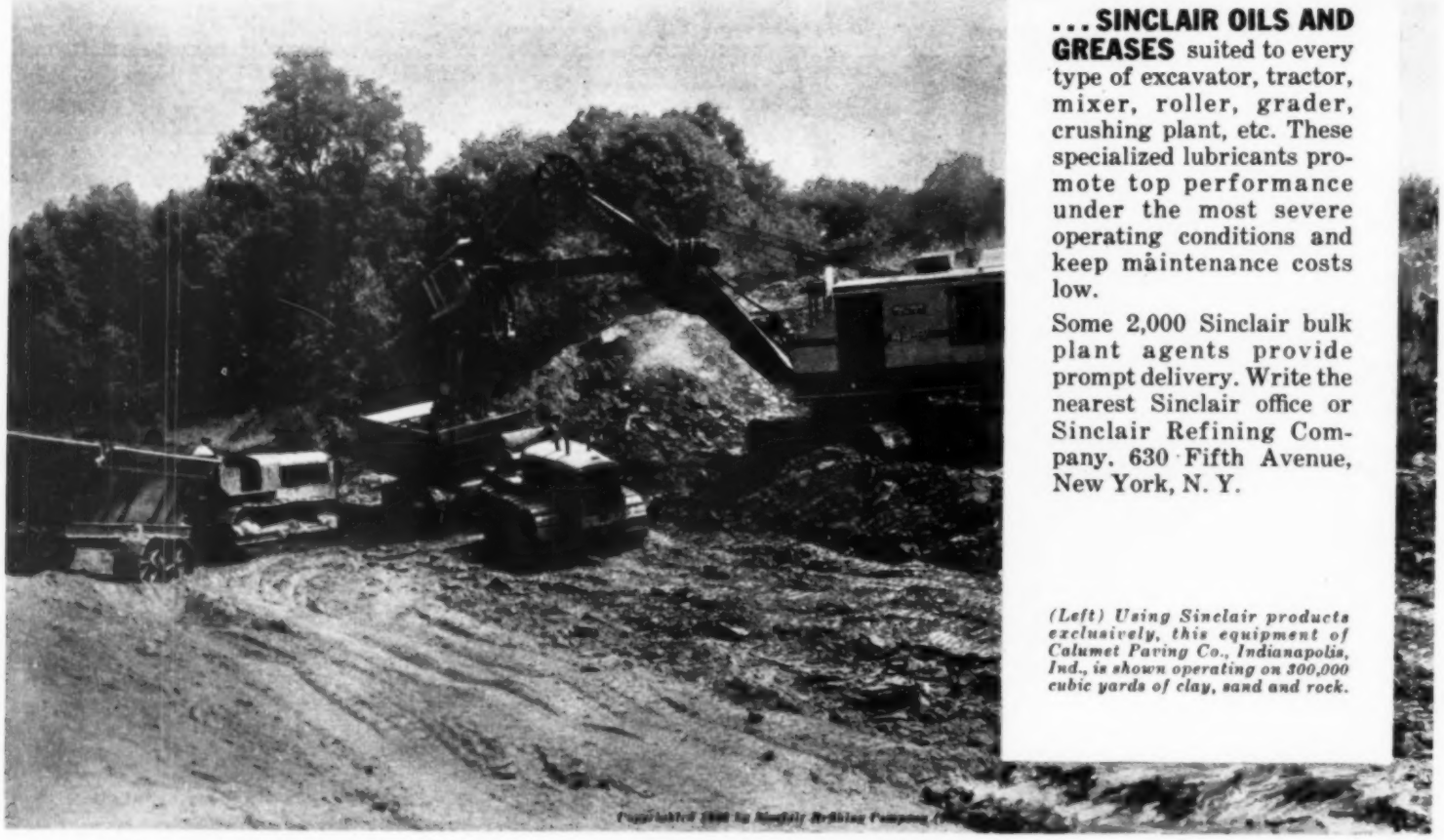
Investigate the Bucyrus-Erie 37-B when you need an excavator that combines the speed necessary for big output with the toughness required to take heavy digging in its stride. Ask about the performance the 37-B has delivered on all kinds of jobs all over the world. Find out how oil-enclosed gears, anti-friction bearings, direct-action control, accessibility of machinery, and other Bucyrus-Erie features mean extra money for you. Study the 37-B and you'll agree it's the finest machine of size on the market. Don't take our word for it; find out for yourself.

Bucyrus·Erie

SOUTH MILWAUKEE, WISCONSIN



MODERN SINCLAIR REFINERIES produce 142 classes of specialized lubricants for industrial use. For *road building and construction machinery* there are...



...SINCLAIR OILS AND GREASES suited to every type of excavator, tractor, mixer, roller, grader, crushing plant, etc. These specialized lubricants promote top performance under the most severe operating conditions and keep maintenance costs low.

Some 2,000 Sinclair bulk plant agents provide prompt delivery. Write the nearest Sinclair office or Sinclair Refining Company, 630 Fifth Avenue, New York, N. Y.

(Left) Using Sinclair products exclusively, this equipment of Calumet Paving Co., Indianapolis, Ind., is shown operating on 300,000 cubic yards of clay, sand and rock.

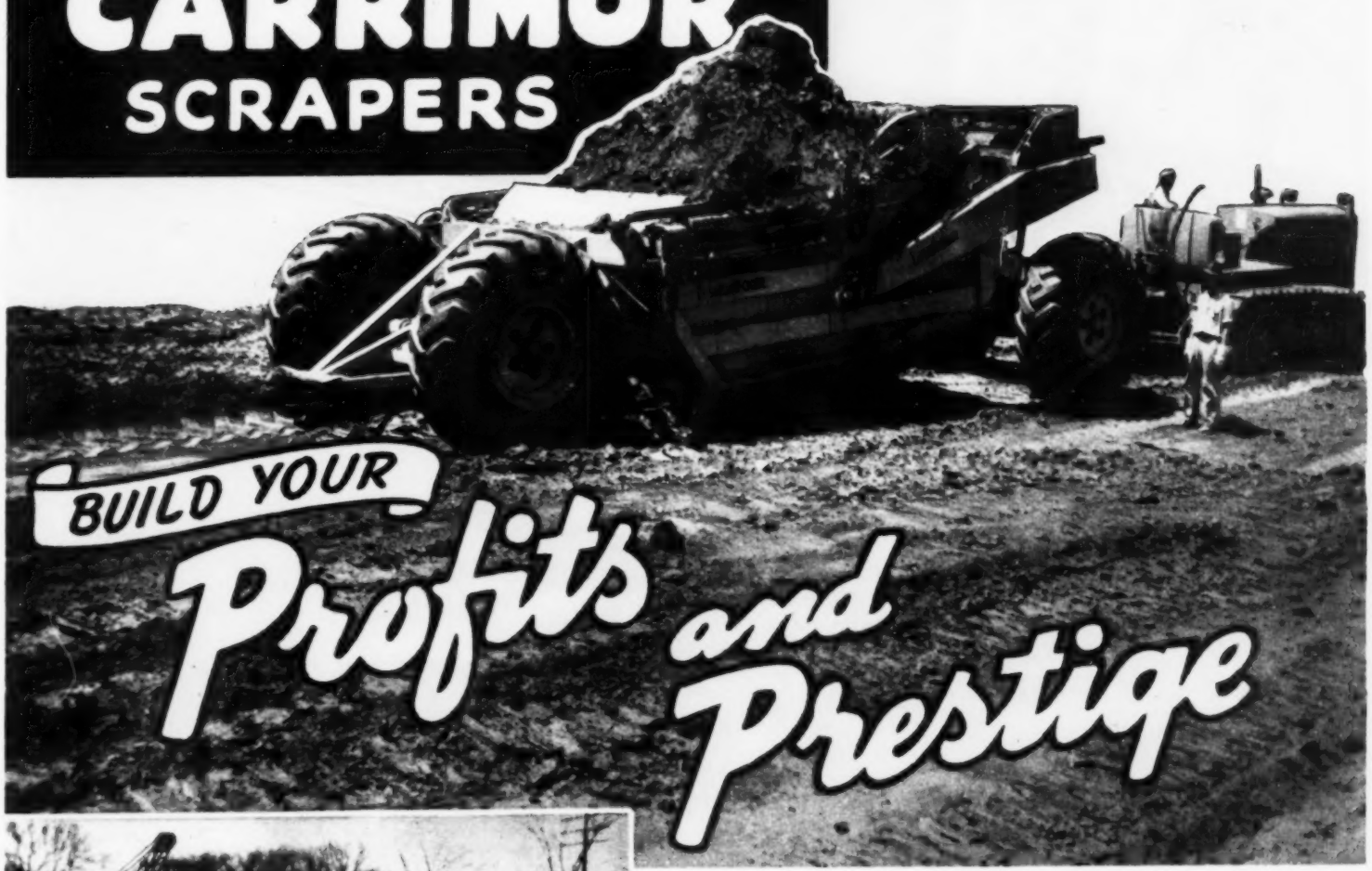
SINCLAIR INDUSTRIAL OILS

SINCLAIR REFINING COMPANY (Inc.)

2540 W. CERMAK RD. CHICAGO · 10 W. 51ST ST. NEW YORK · 1907 GRAND AVE. KANSAS CITY · 573 W. PEACHTREE ST. ATLANTA · FAIR BUILDING, FT. WORTH

In Dirt, Rock or Sand
LAPLANT-CHOATE CARRIMOR SCRAPERS

LAPLANT-CHOATE MEANS Lower Costs



BUILD YOUR Profits and Prestige



Save The Cost Of Extra Hauling Equipment

Complete absence of overhead obstructions makes loading rock and other material from a power shovel easy and economical. The load can be hauled and dumped — thus doing away with the need for extra hauling equipment. Hence your Carrimor is kept busy . . . and profitable! This double duty feature adds to the popularity of this big, highly efficient scraper.

HERE is one of the most versatile and profitable pieces of equipment you can have on your jobs — the big LaPlant-Choate Carrimor Scraper. Quicker, easier loading . . . faster, cleaner dumping . . . time and money-saving mobility are field proven advantages engineered and built into the Carrimor.

Carrimor Forced Ejection Scrapers are scientifically designed to reduce loading resistance. The narrower cutting width plus greater loading ease permit taking a deeper bite. The high lifting front apron and freedom from internal or overhead obstructions assure fast, clean dumping of all types of material. High clearance, low center of gravity and scientifically equalized weight distribution mean stability and mobility.

Designed for use with "Caterpillar" Track-type tractors. Available in 4 sizes. Sold and serviced by your nearest LaPlant-Choate and "Caterpillar" dealer. Modernize now for better earnings. Write today for Free literature and full details.

TAMPING ROLLERS
BULLDOZERS • TRAILBUILDERS

SCRAPERS
BRUSH CUTTERS • SNOW PLOWS

LA PLANT-CHOATE MANUFACTURING CO. Inc.

CEDAR RAPIDS, IOWA.

LIMA

BUILT ESPECIALLY FOR BIG OUTPUT IN ROCK DIGGING

SAMMONS-ROBERTSON-HENRY CO., FRANKLIN DAM, N. H.



WHEN YOU HAVE ROCK TO MOVE, DON'T SEND A BOY--BE SURE WITH LIMA

The Sammons-Robertson-Henry Company, Franklin, New Hampshire, did not send a boy to market when they put their LIMA to digging stone on the Franklin Falls Dam job. Their past experience with LIMA shovels proved to them that LIMA is the right shovel for big output in rock digging. Because of LIMA'S superior design and rugged construction, they get the tough assignments everywhere. Any shovel can dig dirt, but it takes a shovel like LIMA, built especially for rock, to give steady production in such difficult digging.

LIMA LOCOMOTIVE WORKS, Inc.
Shovel and Crane Division LIMA, OHIO, U. S. A.
NEWARK, N. J. NEW YORK, N. Y. DALLAS, TEXAS PORTLAND, ORE.
MEMPHIS, TENN. LOS ANGELES, CALIF SAN FRANCISCO, CALIF.
SEATTLE, WASH. PHILADELPHIA, PA. SPOKANE, WASH.
MONTREAL, QUEBEC, CANADA VANCOUVER, B. C

Sammons-Robertson and affiliated Companies, Huntington, W. Va., are long time users of LIMA Excavators.

2 LIMAS on Franklin Dam Job
SAMMONS-ROBERTSON-HENRY CO.
2 LIMAS on Santee-Cooper Project
SAMMONS-ROBERTSON CO.
1 LIMA at Charleston, W. Va.
SAMMONS-ROBERTSON CO.
2 LIMAS on Pensacola Dam
SAMMONS-ROBERTSON CO.

TOTAL 7 LIMAS SINCE 1936

LIMAS ARE BUILT IN ¾ YARD CAPACITY AND LARGER

AN OPEN LETTER...

HAZARD WIRE ROPE DIVISION
OF
AMERICAN CHAIN & CABLE COMPANY, INC.
WILKES BARRE, PA

To Wire Rope Users:

If there be one thing in which we have more pride than in our product—it is our customers.

Their faith in Hazard Wire Rope—their confidence in Hazard counsel—their belief that Hazard prices are fair and assure obtaining more than average service return for their money—continuously spur our organization to develop an even finer wire rope rather than to produce the greatest volume.

We do not make as much wire rope as some manufacturers. What we make we try to make well. That some customers have bought Hazard Wire Rope for 30 years—40 years—even 50 years—encourages us to hope that we have not labored in vain.

To merit such loyalty is our purpose for today and the future as it has been in the past.

In saying this, we believe we speak for every member of our organization.

Vice President

ACCO

HAZARD LAY-SET
Preformed



PLENTY OF ROOM!

SO you think you might be cramped for space in a rush-hour subway car? Well, maybe, but compared to the fit of a modern bearing, you've got more than plenty of room.

.002 of an inch clearance is all the bearings get in many of today's precision machines. And that's enough for cool comfort . . . as long as the lubrication is right.

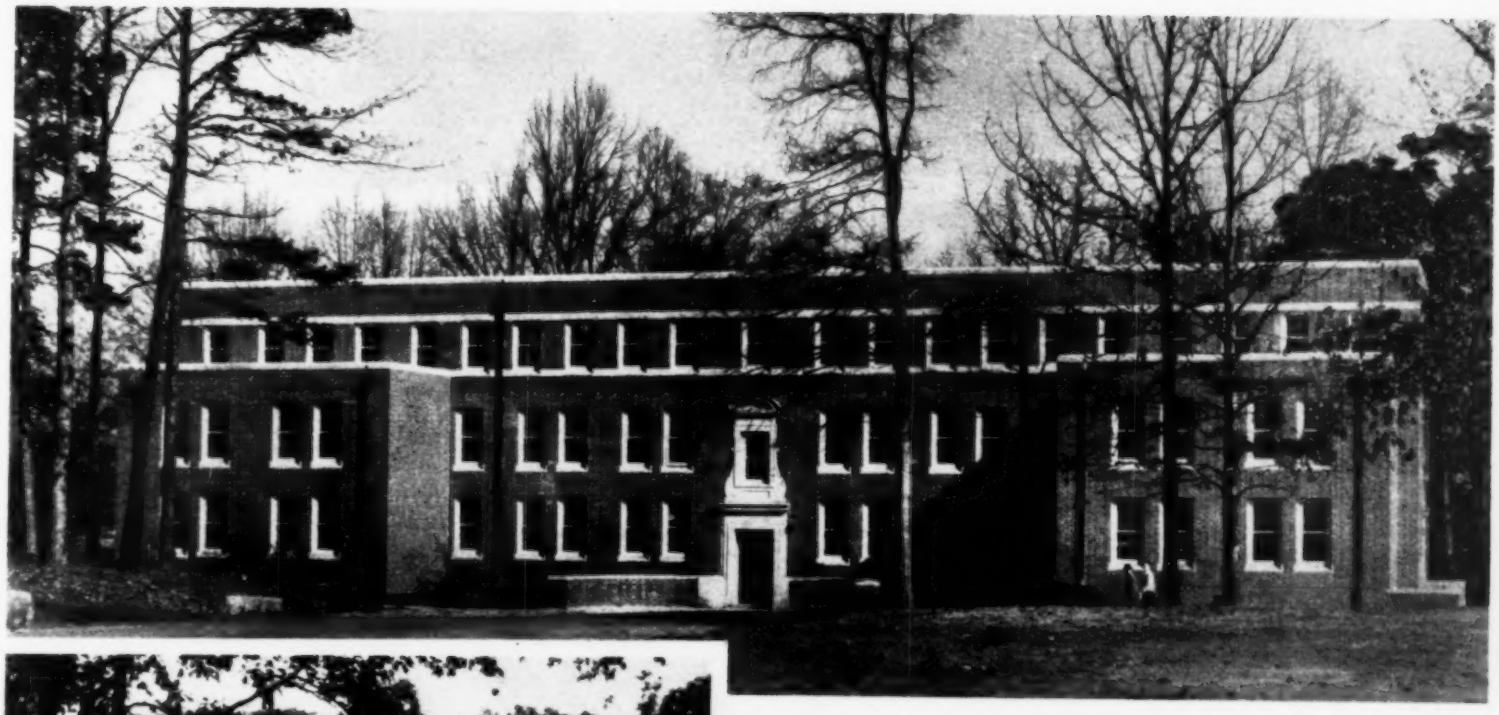
Just a thin film of oil does the trick. But if that film fails . . . look out! It's got to be there *all the time*, at slow speeds, at high speeds, and particularly when there's a sudden increase in load.

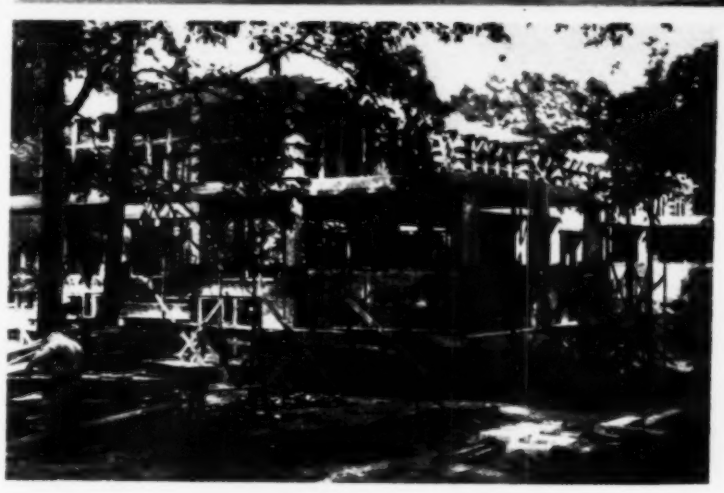
Here at Shell we've studied oil for years. And we've spent a great deal of time and money developing lubricants that stay on the job and maintain that vital oil film.

Many of these lubricants have made machines run better, smoother, more dependably . . . in plants just like yours. If you're operating some bearings that need more attention more often than they should, the chances are your Shell lubrication man has the answer.

SHELL

SHELL INDUSTRIAL LUBRICANTS





DORMITORY, DAVIDSON COLLEGE
Davidson, N. C.
Architect: Henry C. Gibbs
Nashville, Tenn.
Contractor: F. N. Thompson,
Raleigh, N. C.

The quick answer when the demand is rush!

"This was a rush job, and it was necessary that the construction of the concrete frame be completed just as soon as possible. By using Lehigh Early Strength Cement, we were able to remove forms and re-use them with almost no delay. The time saved by this was considerable—we were also enabled to reduce the cost of the form work more than enough to offset the additional cost of high early strength cement."

This is what F. N. Thompson, General Contractor, Raleigh, N. C., wrote concerning the Davidson College Dormitory.

In 24 to 48 hours concrete made with Lehigh Early Strength Cement equals the strength of normal cement concrete at 7 days. This big time saving in getting service strength concrete explains why form costs can be reduced by quick re-use—why per yard concrete costs can be lower—why construction can be continuous for quick completion—why overhead costs are reduced commensurate with shorter job duration—why cold weather heat protection costs are reduced one-half or two-thirds.

LEHIGH EARLY STRENGTH CEMENT

Use Lehigh Early Strength Cement for any concrete when time saving reduces costs, or when quicker completion is of advantage. It produces service strength concrete three to five times faster—makes better, denser concrete. The Lehigh Service Department will gladly answer any questions.

LEHIGH PORTLAND CEMENT COMPANY

Allentown, Pa., Chicago, Ill., Spokane, Wash.

BRUTE STRENGTH



PURPLE STRAND

THE place to judge wire rope is in action—straining over sheaves, groaning under the load of heavy boulders, while the bucket's biting into tough digging—day after day, month after month.

That's why we say: "Try Purple Strand yourself . . . then decide."

This husky rope packs power from core to crown. Only premium Improved Plow Steel is used. Each wire is drawn to precision tolerances. Each rope is accurately designed. The strands that make up the rope are scientifically lubricated and fitted together with as much precision as the parts of a fine machine.

Get Purple Strand in any wire rope construction . . . Regular or Lang Lay . . . pre-formed or non-preformed . . . with your choice of a hemp center or an IWRC.

AN IDENTIFYING MARKER IN EVERY ROPE

An exclusive identification tape—known as Telfax—is laid next the core of every Bethlehem Wire Rope. This tape is plainly marked with the grade of steel in the rope ("Cast," "Plow," "Improved Plow," etc.). Just open the strands a little, look at the tape and you're sure you have the right grade of steel for the job. Telfax tape prevents the possibility of mistakes, and thus contributes to the protection of lives and property.

BETHLEHEM STEEL COMPANY

SHEARED RIVETS? LOOSE BOLTS?



NOT SINCE WE'VE HAD ALL-WELDED CONSTRUCTION!

You'll say goodbye to most of the old excavator troubles from the moment you own your first P&H. That's no vague promise — it's fact, based upon the experiences of hundreds of contractors who've owned them as long as six years. P&H all-welded construction of alloy rolled steels gives you an excavator that's huskier, more rigid — for greater protection against layups and repair bills. At the same time, these machines, because deadweight has been removed, work faster and cost less to operate. We believe the machine that does more at lower cost, earns more money for its owner. If that makes sense to you, you're invited to get full information about these P&H's.

P&H EXCAVATORS

★ *Ask about the new P&H Excavator Control — the key to smoother, faster operation! Bulletin X-60.*



The P&H Model 455 (1 yard) is convertible for six types of service, including shovel, dragline, clamshell, trench hoe, skimmer scoop or pile driver. Increased mobility is provided through tractor-type crawlers for easier handling over all types of ground. Standard power is Diesel. Ask for bulletin X-11.

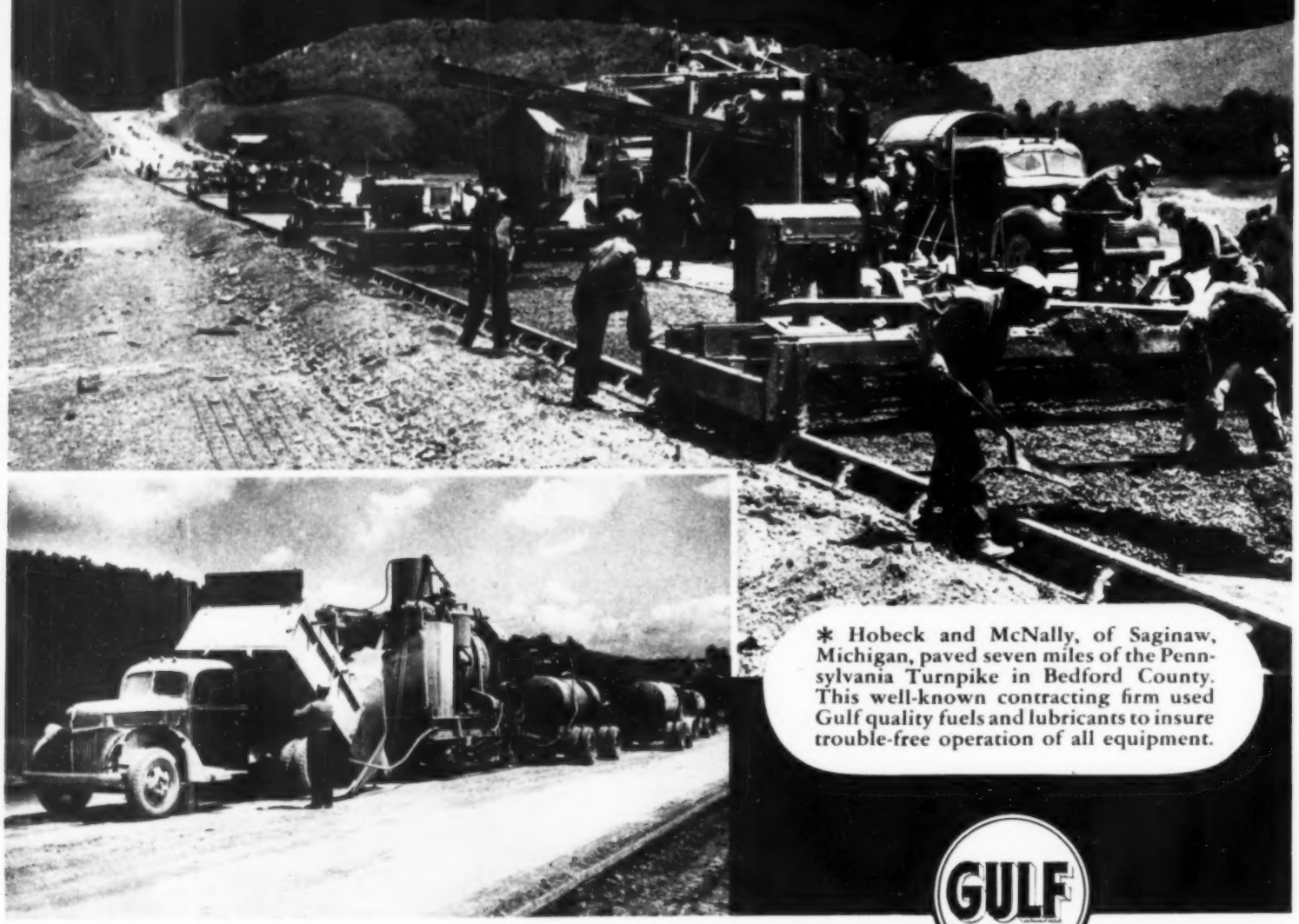
P&H excavators are made in 18 different sizes, from ⅜ to 5 cu. yds. capacity; gasoline, Diesel or electric power. Literature is available on all models.

GENERAL OFFICES: 4494 WEST NATIONAL AVENUE, MILWAUKEE, WIS

HARNISCHFEGER CORPORATION

EXCAVATORS • ELECTRIC CRANES • ARC WELDERS P&H HOISTS • WELDING ELECTRODES • MOTORS

"We Finished Our 7-Mile Stretch *on schedule* with GULF FUELS and LUBRICANTS" ... SAYS TURNPIKE PAVING CONTRACTOR*



* Hobeck and McNally, of Saginaw, Michigan, paved seven miles of the Pennsylvania Turnpike in Bedford County. This well-known contracting firm used Gulf quality fuels and lubricants to insure trouble-free operation of all equipment.

GULF

"It paid us to use GULFPRIDE, the world's finest motor oil"

"WE had to be 100% sure that our equipment would give us a full 24 hours' work every day—that's why we took no chances and used Gulf's higher quality fuels and lubricants," says this Turnpike Paving Contractor. "The extra hours we saved through high lubrication efficiency played an important part in the completion of our contract right on schedule."

Gulf's higher quality lubricants and fuels were used by a majority of the nationally known contractors on this huge project! Modern lubrication practice, recommended by the Gulf engineer, helped to eliminate loss of time and equipment repair cost.

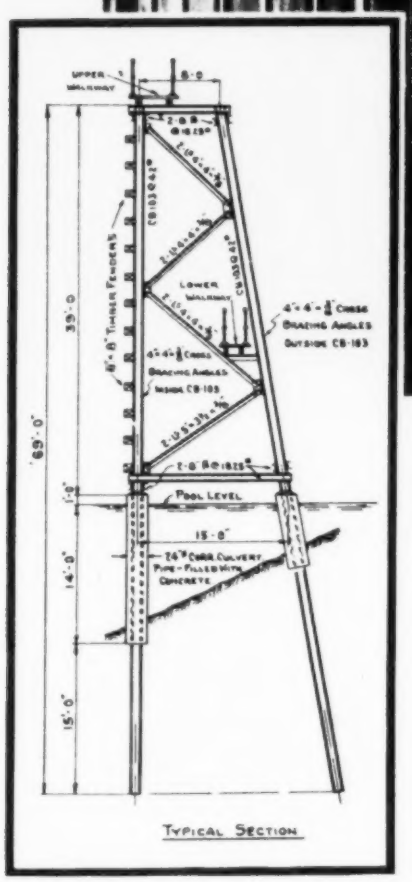
Don't start another job without the benefit of GULF PERIODIC CONSULTATION SERVICE. It is available to contractors in 30 states from Maine to New Mexico at no extra cost. No matter where your are working, you are sure of quick delivery of Gulf products through 1100 warehouses located at principal distributing points. Write or 'phone your nearest Gulf office today.

Erskine & Sons, Inc., of Lowellville, Ohio, handling the batchwork on this Turnpike paving contract, also standardized on Gulf quality lubricants and fuels.

Rebuilt of Steel

...TO MAKE IT STRONGER
TO MAKE IT LAST LONGER





ENGINEERING FACTS: The U·S·S Bearing Piles and Sheet Piling were driven by No. 9B-2 McKiernan-Terry Steam Pile Hammer handled by derrick boat equipment. Work progressed rapidly—the whole job, including the razing of the old wooden structure, being completed within 10 weeks. All Bearing Piles are protected against waterline corrosion by concrete sheathing poured inside a steel sleeve, extending from the river bottom to above normal river stage. *Contractors: Pihl & Miller, Inc., Pgh., Pa.*

U·S·S Steel Bearing Pile construction adapts this coal dock to meet the hazards of flood waters, churning ice, the battering of barges.

CONSERVATIVELY figured, this sturdy steel structure should easily last 20 to 25 years—twice as long as the wooden dock it replaces, though it costs only 25% more.

Located on the Ohio River at East Steubenville, W. Va., this unloading dock, built for the By-Products Plant of the Wheeling Steel Corporation, handles 2000 tons of coal daily.

Photograph and diagram show the simplicity and obvious structural efficiency of the design. U·S·S Steel Bearing Piles, CB Section-103, 75′ long, driven to an average depth of 30′ into sand and gravel river bottom, act both as bearing piles and as supporting columns in the A-frame trestle bents. These are set on 10′ centers and braced internally and one to the other with steel cross-bracing angles, bolted and welded. This construction insures maximum strength yet has sufficient "give" and resilience to safely absorb the crash of flood-borne loads and the impacts and lateral shocks to which this dock is subjected. Twelve of such trestle bents set on each side of the coal hoist proper provide a dock 340 ft. long overall.

Note the circular ice-breaker and mooring cell located on the down-stream end of the dock. Here U·S·S Steel Sheet Piling, Section M-112, in 75′ lengths is driven in a self-enclosed circular cell to a 30′ minimum penetration. No internal bracing was required—the cell being stabilized by a sand and gravel fill—and finished off with a 2′ concrete internal cap.

It will pay you to investigate the economic possibilities of U·S·S Steel Bearing Piles and Sheet Piling for all engineering projects, such as dock and pier construction, abutments, cofferdams, and retaining walls, and for all foundation problems which involve the use of piling. The specialized experience of our engineering department is at your service.

UNITED STATES STEEL

Steel Bearing Piles and Piling

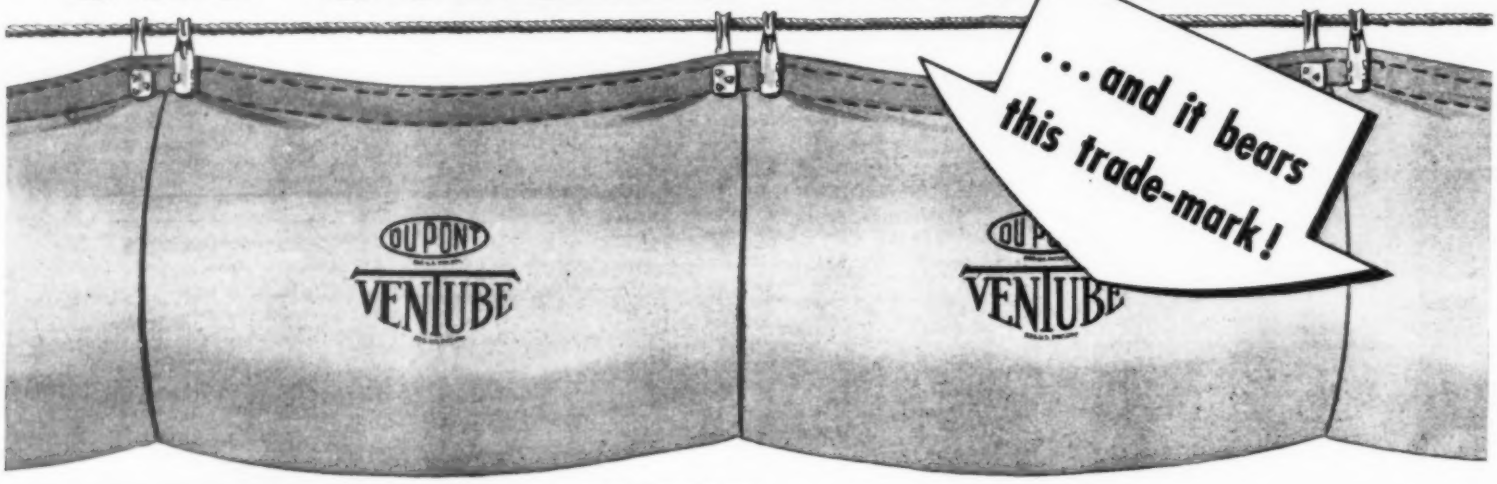
CARNEGIE-ILLINOIS STEEL CORPORATION

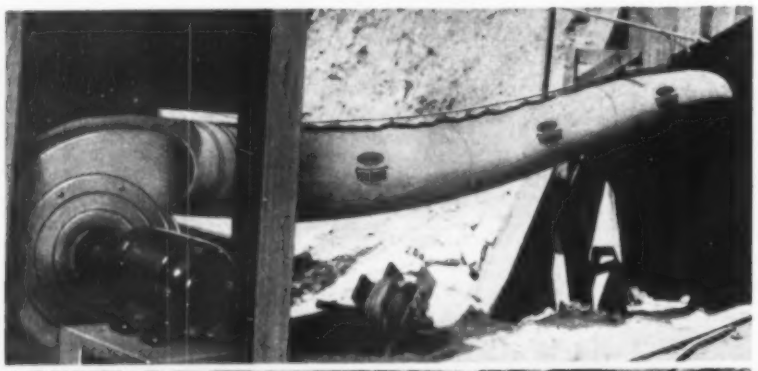
Pittsburgh and Chicago

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*

United States Steel Export Company, New York

REMEMBER! There's Only One Genuine VENTUBE*!









"VENTUBE" gives you these outstanding advantages

1. You don't need any massive, expensive machinery to insure best ventilating results in your tunnel. No, sir! All the equipment necessary is a motor-driven fan of proper capacity and enough "Ventube" to reach your workings. All you do is turn on the fan and presto—clean, fresh air sweeps into your tunnel, helping you to speed up work and cut costs!

2. Here's "Ventube" at work for the Bridgeport Hydraulic Co. near Weston, Connecticut. Notice how straight this superior rubberized ventilating duct hangs . . . no kinks or bulges to impede the flow of fresh air. Every joint is made air-tight by time-saving detachable couplings! "Ventube" is flexible and light weight. It's so easy to handle that one man can install the whole system within a few hours!

3. "Ventube" gets right up to the face, where fresh air is needed most of all! Before blasting it's easy to slide back the sections nearest the heading. Afterward, "Ventube" slides quickly back into place, bringing fresh, pure air from the outside.

* * *

▶ "Ventube" is amazingly tough and durable! It's made of extra-heavy, long-fibered cloth woven to high Du Pont standards. This cloth and even the thread that goes into the making of "Ventube" are first processed with a special treatment to resist fungus growth. Then this pre-treated fabric is both coated and impregnated with rubber to resist acid, water, gases and rot! And "Ventube" can withstand terrific concussions because it's as strong in the warp direction as in the filler. We'll be glad to submit estimates on jobs you're figuring. Write Du Pont today!

DU PONT VENTUBE

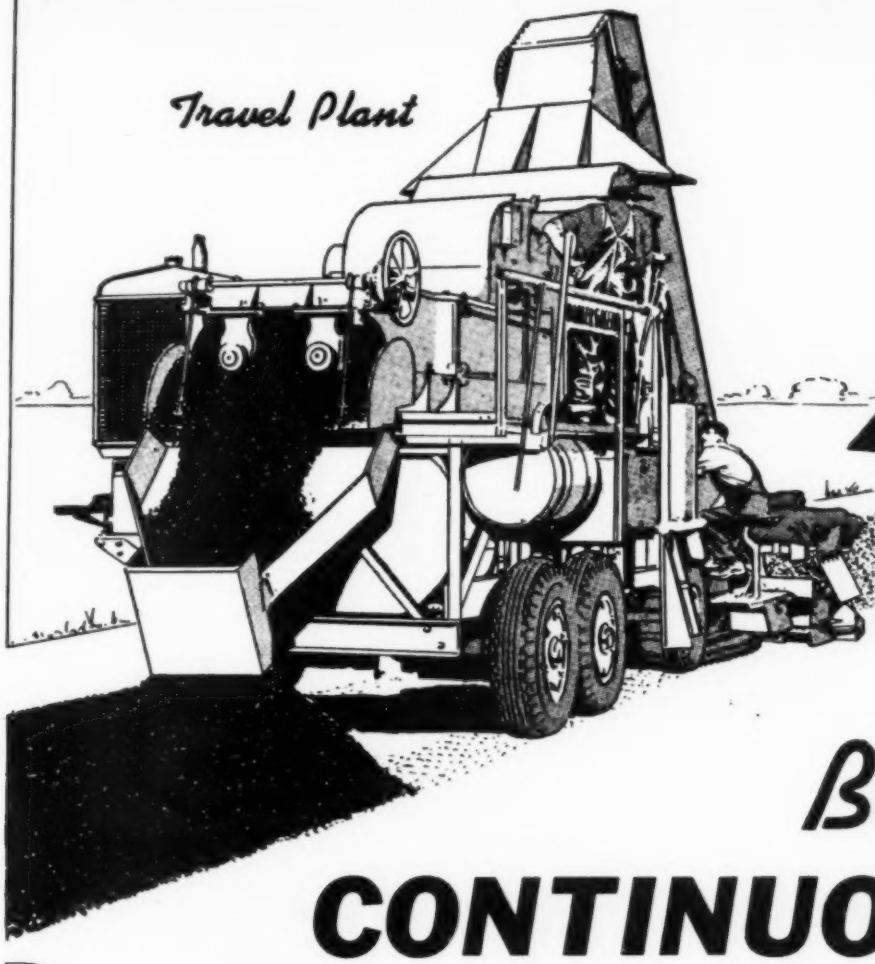
E. I. DU PONT DE NEMOURS & CO. (INC.)
"FABRIKOID" DIVISION · FAIRFIELD, CONN.

**"VENTUBE" is Du Pont's registered trade mark designating its rubber impregnated flexible ventilating duct.*

THE FLEXIBLE VENTILATING DUCT

● This roomy, compact powder bag is made of the same sturdy material as is "Ventube." The seams are sewed as tough as rawhide—and the fabric is coated and impregnated with thick, resistant rubber. Du Pont powder bags are available in several sizes. Write for sizes and prices.





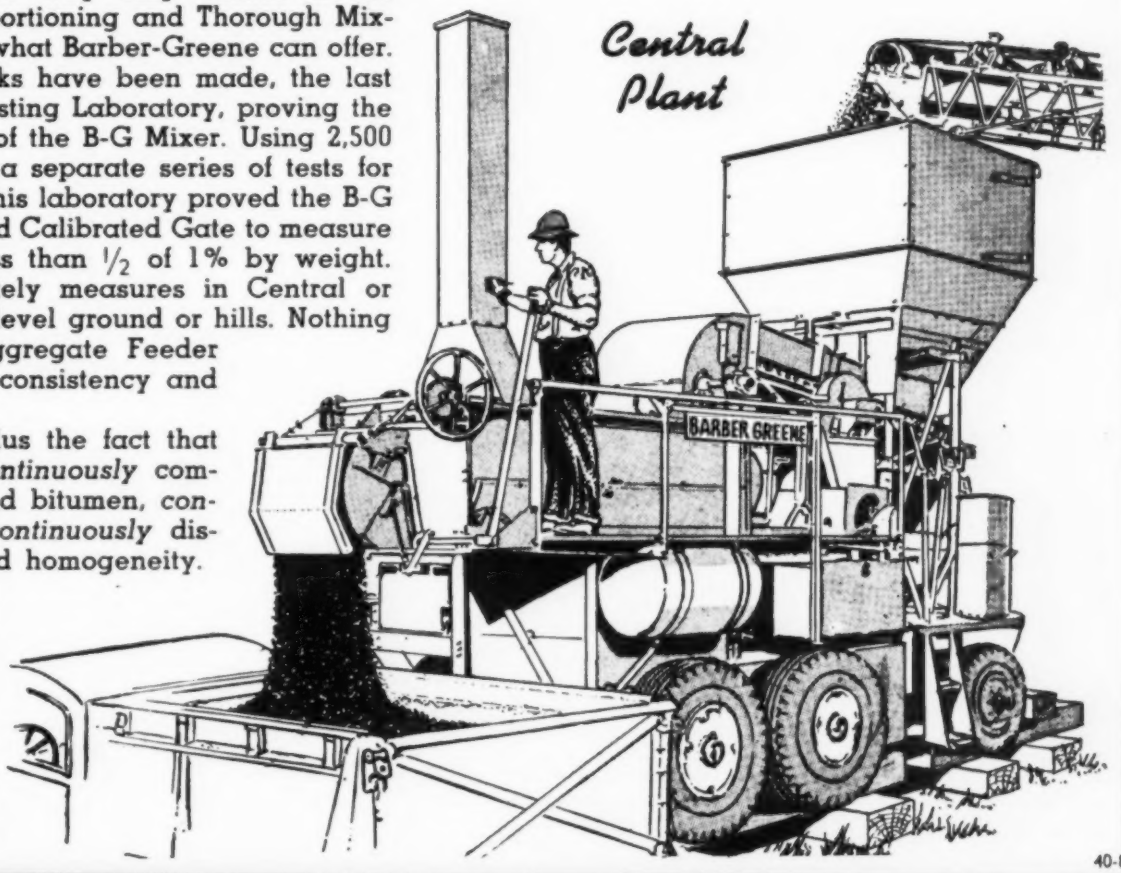
ACCURACY WITHIN 1/2% with the Barber-Greene CONTINUOUS MIXER

DID you ever wonder why only Barber-Greene preaches "Accurate Proportioning and Thorough Mixing"? It's because that's what Barber-Greene can offer.

Many convincing checks have been made, the last being by the Chicago Testing Laboratory, proving the almost perfect accuracy of the B-G Mixer. Using 2,500 pound samples, running a separate series of tests for each size of aggregate, this laboratory proved the B-G Positive Apron Feeder and Calibrated Gate to measure the aggregate within less than 1/2 of 1% by weight. The B-G Feeder accurately measures in Central or Travel Plant set-ups, on level ground or hills. Nothing short of a POSITIVE Aggregate Feeder will give this unrivaled consistency and accuracy.

These fundamentals plus the fact that the Barber-Greene is *continuously* combining the aggregate and bitumen, *continuously* mixing, and *continuously* discharging, give unequaled homogeneity.

Technical or practical proof is yours. Write for a report on these tests, or the names of some of the B-G owners who have mixed the thousands of miles that prove the theory that only Barber-Greene can preach.



40-8

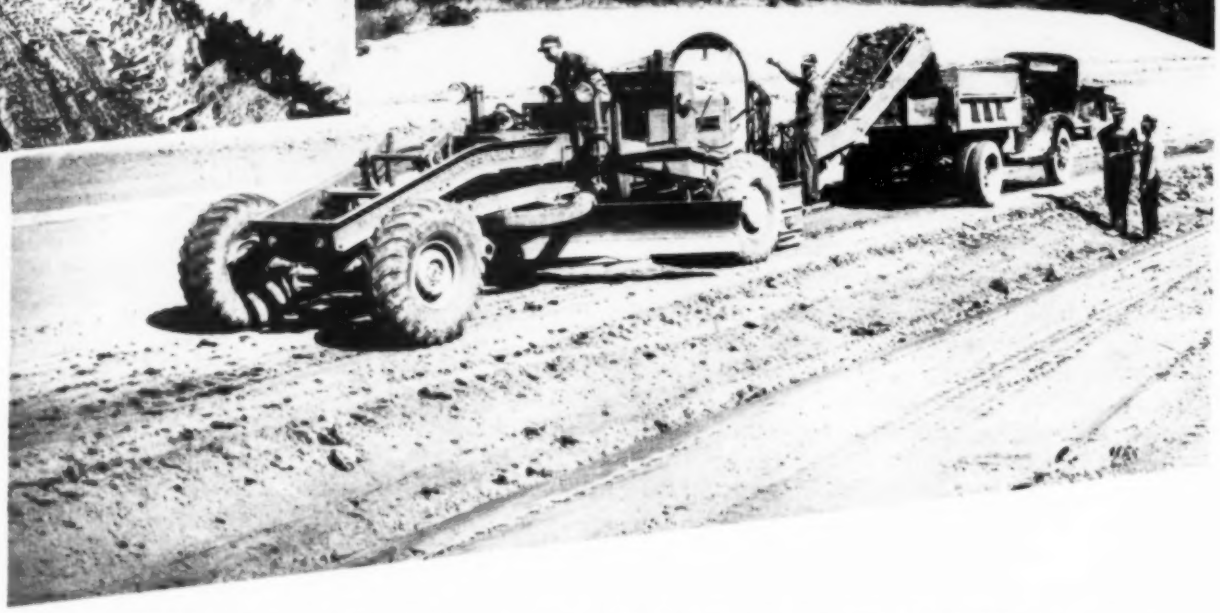
BARBER GREENE
STANDARDIZED MATERIAL HANDLING MACHINES
AURORA ILLINOIS

WHEN THE CALENDAR SAYS:

"STEP ON IT"

GEAR UP WITH A "99"





"99" Finisher Blade, elevated to trim down high bank.

On operations of this type the "99" Loader picks up and delivers 75 to 100 cubic yards an hour into trucks.

● At any season, the "99" is the most useful power grader made. But its ability to handle so many more kinds of work so much better and faster is especially valuable when the calendar warns that approaching Winter calls for quick completion of many operations.

The distinctive power, traction and maneuverability made possible by the "99's "ALL-WHEEL DRIVE AND STEER enables you to swing it into one operation after another in a manner that makes every minute count. And when Winter puts other equipment in the storage yard, the "99" can be hired out for snow plowing. It can't be matched for speed, efficiency and ability to drive through big drifts on both curves and straightaways.

The multiplex advantages of the "99" as a power grader have been expanded to many operations usually requiring special machines by the development of special attachments. With this power grader you can skin off sod and load it into trucks, pick up excess dirt on shoulders or between forms faster and cheaper. It will take heavier cuts from banks or slopes, do a cleaner job on shoulders, bulldoze heavier loads; scarify with lighter draft and get better disintegration.

See a "99" at work. Learn what its power, ability and economy can mean to you every month of the year for many years. THE AUSTIN-WESTERN ROAD MACHINERY CO., Aurora, Illinois.

Motor Graders
Loaders
Blade Graders
Elevating Graders
Hydraulic Scrapers
Crushing and Screening Plants
Cable Scrapers
Rollers
Roll-A-Planes
Motor Sweepers
Bituminous Distributors
Shovels and Cranes

Austin-Western

BUCYRUS ERIE

SCRAPERS

have what it takes to give you

LOW COST DIRT

1 Short-distance loading with minimum draw-bar pull.

2 Boiling action that puts dirt into the corners and loads both apron and bowl.

3 Line-of-plate struck measure capacity ratings; you get more pay dirt per yard of rated capacity with Bucyrus-Erie scrapers than with any of the others.

4 Easy loading of hard-digging materials with extended-center cutting edge.

5 Accurate control of cutting depth.

6 Ability to cut a nearly vertical bank.

7 Ease of hauling with dead weight reduced to a minimum.

8 Plenty of tire-area to keep on top of the ground.

9 Short turning radius.

10 Stability on turns.

11 Easy ejection with dirt broken up by the loading action.

12 Fast ejection of rolling dirt with low power consumption.

13 Clean ejection with bowl tilted positively to a sharp angle.

14 Accurate control of spreading depth with 2-line operation.

15 Spreads dirt from a thin layer up to maximum depths of 10, 12, 13, or 17 inches depending on size of scraper.

16 Or dumps in a single heap.

17 Can dump while standing still.

18 Ability to divide the dumped load: can dump load by stages to fill low spots.

19 Smooth accurate finishing, level-center cutting edge available if desired.

20 Dumps or spreads close to the edge of a fill.

21 Stability for finishing side slopes.

22 Easy-operating, simply-constructed, cool-running winches.



SEE YOUR INTERNATIONAL INDUSTRIAL POWER DEALER

Bucyrus·Erie

SOUTH MILWAUKEE, WISCONSIN

Try it...then Compare

...THAT'S ALL WE ASK!





YEARS OF RESEARCH DEVELOPED "BLUE CENTER"

Years of research have gone into the development of Roebling "Blue Center" Wire Rope.

Furthermore, the development and improvement of Roebling "Blue Center" is a never-ending process. A planned program of research is carried on ceaselessly in the Roebling Research Laboratory — one of America's most modern and completely equipped research units.

WE INVITE YOU to put Roebling "Blue Center" Wire Rope to the severest service test you know of — on any of your rope-rigged equipment. We will stand by the results. We say this without hesitation — for we know the capabilities of "Blue Center" on a wide variety of equipment, under severest operating conditions.

Keep in mind that nearly 100 years of Roebling wire fabricating experience have gone into the development of Roebling "Blue Center" Wire Rope. It is Roebling's highest achievement in wire rope manufacture. Specially developed through years of research, to provide maximum rope durability, safety and economy — Roebling "Blue Center" has established unexcelled records for long, low-cost service.

Try this rope on your shovels, scrapers, cranes, or other rope-rigged equipment. Keep accurate service records. Compare. We are confident you will agree with other users — that Roebling "Blue Center" assures lowest rope replacement cost.

JOHN A. ROEBLING'S SONS CO.
Trenton, N.J. Branches in Principal Cities

ROEBLING "BLUE CENTER" The Finest of all Roebling Wire Ropes

TWO GREAT BIG ADVANTAGES

On the one hand . . .

Greater Safety

Atlas Manasite Detonators have been accepted as a great advance in safer blasting. Through reduced sensitivity to impact and friction, they make safety precautions not less important but more effective than ever. Laboratory tests and field experience both prove that Atlas Manasite Detonators are great aids to safety practices.

On the other . . .

Dependability in Action

Blasters who try Atlas Manasite Detonators continue to use them. More than 80,000,000 have been used—proof aplenty of dependability. Yet they cost no more. Are you using Atlas Manasite Detonators?

Your Atlas representative has full details. He'll be glad to call at your convenience.

ATLAS MANASITE DETONATORS

Another "ATLAS FIRST"

ATLAS POWDER COMPANY, WILMINGTON, DEL.

Cable Address—Atpowco

Everything for Blasting

OFFICES

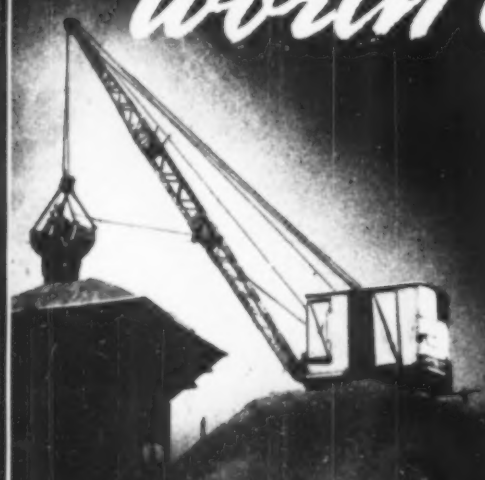
Allentown, Pa.	Denver, Colo.	New Orleans, La.	Pittsburgh, Pa.	Spokane, Wash.
Boston, Mass.	Houghton, Mich.	New York, N. Y.	Portland, Oregon	St. Louis, Mo.
Butte, Mont.	Joplin, Mo.	Philadelphia, Pa.	Salt Lake City, Utah	Tamaqua, Pa.
Chicago, Ill..	Knoxville, Tenn.	Picher, Okla.	San Francisco, Calif.	Wilkes-Barre, Pa.
	Los Angeles, Calif.	Pittsburg, Kansas	Seattle, Wash.	

ATLAS

EXPLOSIVES

CHEMICALS ATLAS EXPLOSIVES

$1,300,000 worth of CONFIDENCE





Contractors building the Pennsylvania Turnpike placed confidence in Koehring Heavy-Duty Construction Equipment to the extent of more than $1,300,000. Koehring equipment was used at the very beginning of excavating and grading operations, through the pouring of the slab and finishing of the slab surface.

Confidence, that Koehring Heavy-Duty Construction equipment would, under the high speed Turnpike schedule, carry the load of the extra-service hours without serious interruption of production schedules, is the reason why so many contractors felt secure with Koehring equipment.

To have received this recognition of quality, to have been a part of this modern construction masterpiece, the Pennsylvania Turnpike, is an honor we humbly accept as a vindication of our policy of building quality and service into Koehring equipment.

Many more millions of dollars worth of Koehring equipment is being used daily throughout the country, helping contractors make profits. If you are not a user of Koehring equipment, be sure to obtain complete information about it, before you purchase your next unit — for excavating, hauling, mixing concrete for highways or structures, and other related operations.

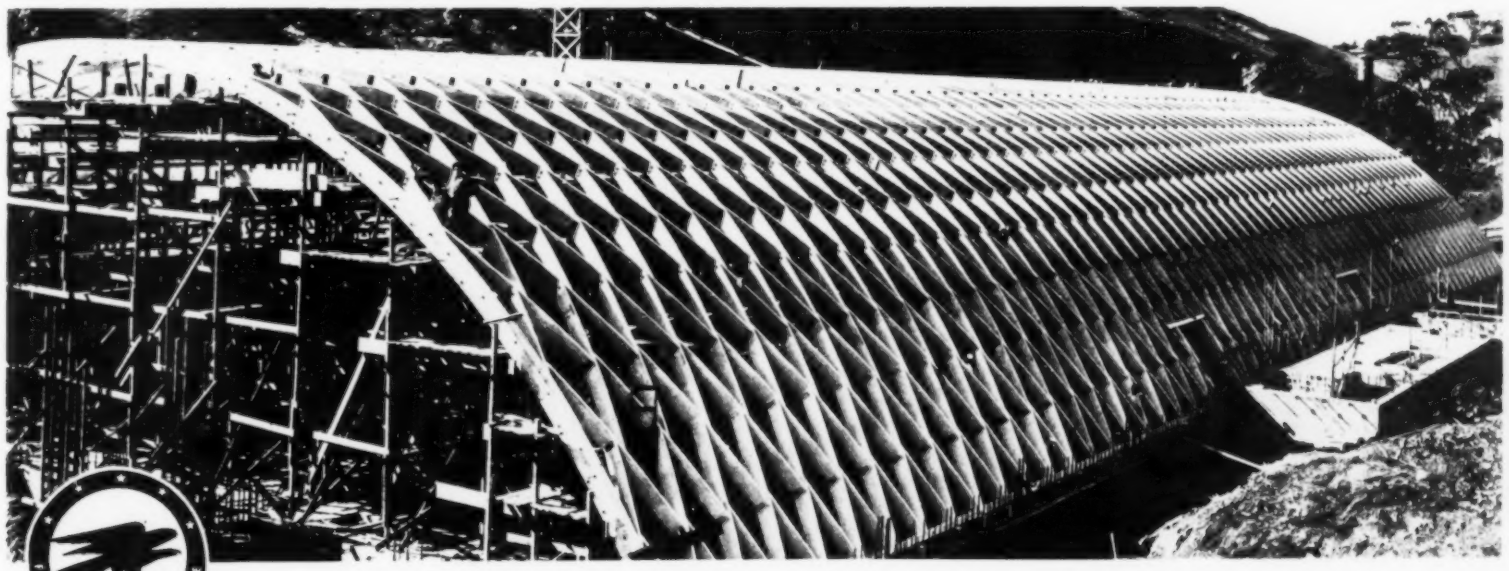
KOEHRING COMPANY
MILWAUKEE, WISCONSIN



Construction Methods

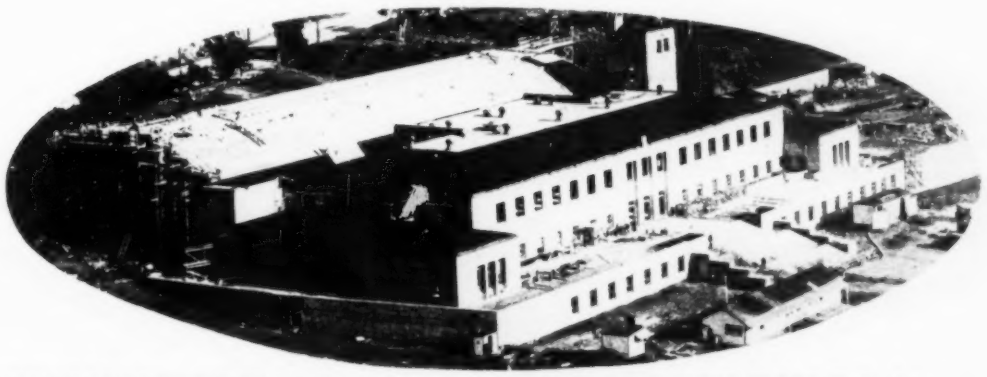
ROBERT K. TOMLIN, Editor

Volume 22 | AUGUST, 1940 | Number 8



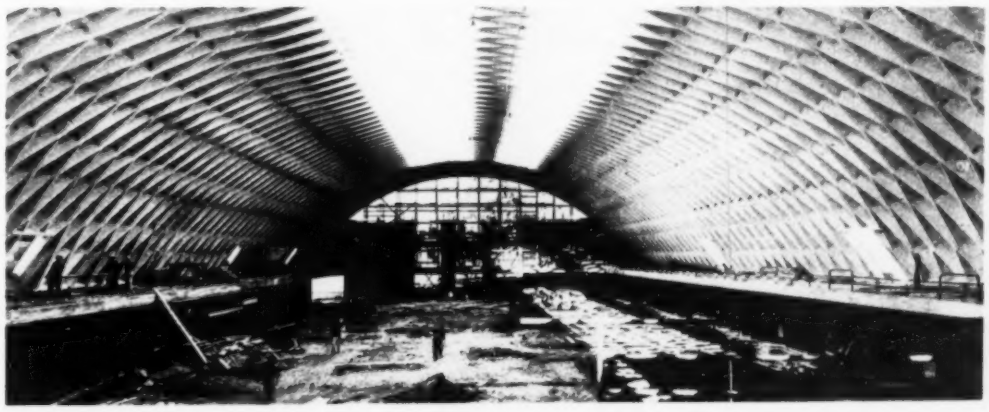
HUGE WOOD ARCH of Lamella construction covers drill deck 265 ft. long and 128 ft. wide for use of Navy and Marine Corps Reserve personnel.

Armory For Naval Reserve Corps Has Huge Wood Lamella Roof



MILLION-DOLLAR ARMORY (above), in rear, is flanked by three-story reinforced concrete administration building, both constructed by WPA forces.

UNOBSTRUCTED DRILL FLOOR (below) is provided by Lamella roof design, which eliminates all columns.



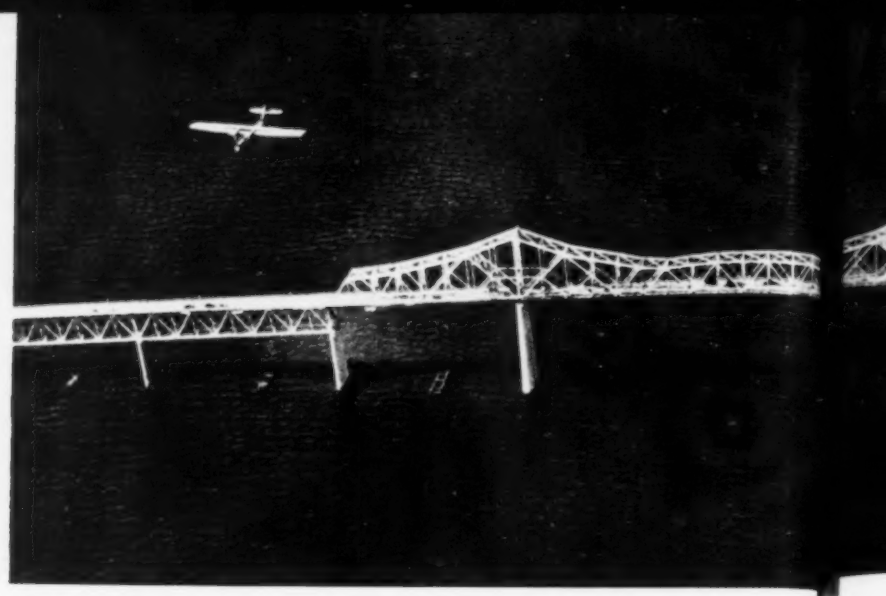
CONSTRUCTION FOR PURPOSES OF NATIONAL DEFENSE in Los Angeles, Calif., has taken the form of a newly completed $1,000,000 armory, the main feature of which is a huge, arch-like Lamella roof of wood covering a drill deck 265 ft. long and 128 ft. wide, without supporting columns or obstructions of any kind. Built by forces of the Work Projects Administration under the sponsorship of Los Angeles County, the structure will provide training facilities for 800 officers and 2,500 men of the Navy

(Continued on page 98)



TOPPING OUT OF COULEE DAM. U. S. Bureau of Reclamation project on Columbia River in Washington, begins as bucket discharges concrete in last lift of forms for block 95 in east abutment of 550-ft. high structure. Tops of huge concrete blocks will carry 30-ft. roadway 0.8 mi. long across dam. Contractors are Consolidated Builders, Inc.

THIS MONTH'S NEWS REEL



JAMESTOWN BRIDGE, completed and dedicated Aug. 3, is $3,000,000 toll structure with length, including approaches, of 7,000 ft. crossing Narragansett Bay, R. I. View shows 600-ft. cantilever forming main channel span erected by Harris Structural Steel Co.



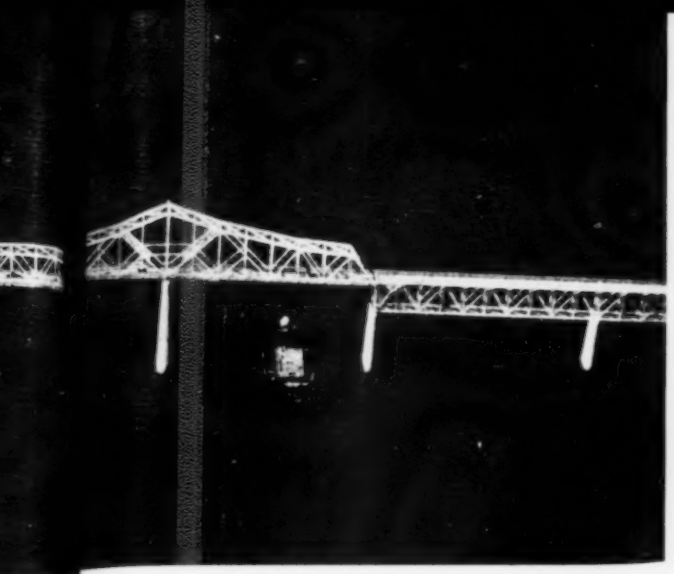
1941 ROAD CONVENTION emphasizing theme, "Roads for Defense," will be held in New York City during week of Jan. 27, according to decision of officers of American Road Builders' Association including (left to right): HERBERT A. ANDERSON, of Chicago, president of Contractors' Division; HAL G. SOURS of Ohio, president, A.R.B.A.; WILLIAM M. PARRISH, president, Manufacturers' Division; and CHARLES M. UPHAM, engineer-director, A.R.B.A.

Photo, Highway Information Service



PENNSYLVANIA TURNPIKE SERVICE STATIONS AND RESTAURANTS (left) are constructed at ten locations along 160-mi. route for Standard Oil Co. of Pennsylvania, concessionaire, at reputed cost of $500,000 by The Austin Co., engineers and builders, of Cleveland, under direction of six men lined up in front of largest (midway) station, at Bedford, connected by pedestrian underpass tunnel with smaller service station on opposite side of divided four-lane highway. Left to right: (1) CHARLES D. KELLY, S. O. field engineer; (2) HARRY BEAMER, S. O. field superintendent; (3) T. G. GUSTAFSON, Austin field superintendent; (4) ALWYN OPPY, Austin field engineer; (5) W. M. BOWMAN, Austin field clerk; (6) GEORGE D. VOGT, S. O. clerical assistant. All buildings are faced with blue limestone backed up by cinder concrete blocks.



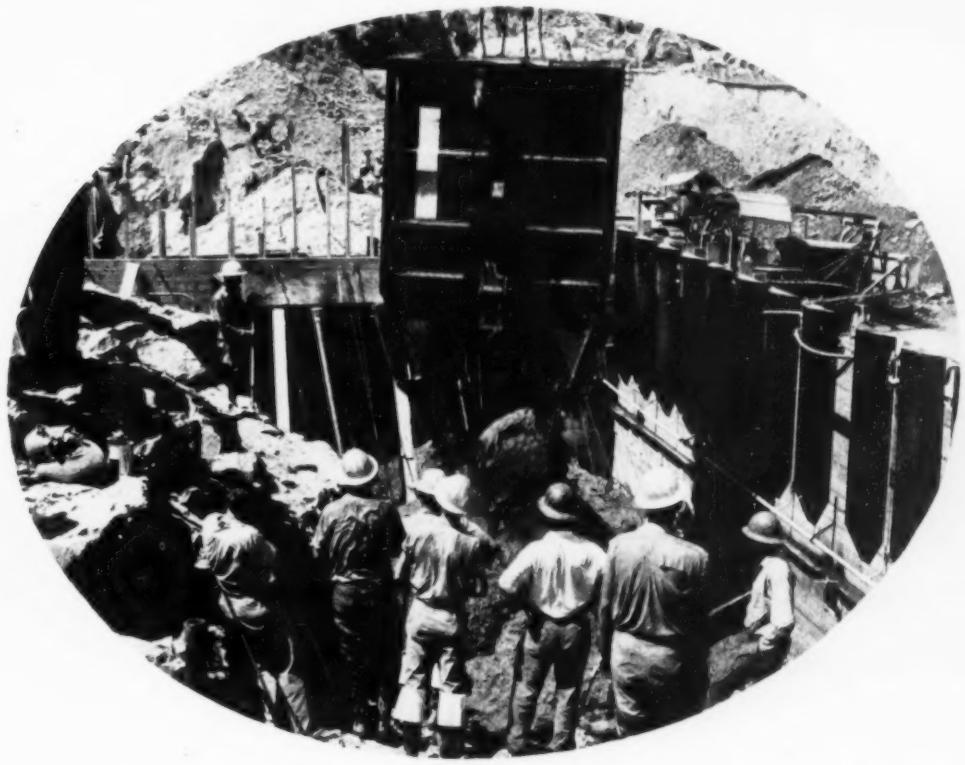




NEW CANADIAN SUPERHIGHWAY is Queen Elizabeth Way providing 91-mi. route between Fort Erie and Toronto. Project is concrete-paved divided lane route with many cloverleafs to eliminate crossings at grade.



FIRST CONCRETE AT SHASTA DAM (right). U. S. Bureau of Reclamation project in California, is placed at 10:02 a.m. July 8 as 8-cu.yd. bucket lowered by cableway dumps into forms for block 38 in east abutment. Structure requiring total of 6,000,000 cu.yd. of concrete is being built under supervision of RALPH LOWRY, **(above, left)** construction engineer for Bureau of Reclamation; and FRANK T. CROWE, general superintendent for Pacific Constructors, Inc.



EAST RIVER DRIVE (below) along New York City waterfront was opened to traffic last month. Built in cramped quarters, as described in detail in "Construction Methods" last month, double-deck viaduct will provide non-stop express route for north-and-south city traffic. Contractors were J. Rich Steers, Inc., and Poirier & McLane Corp.



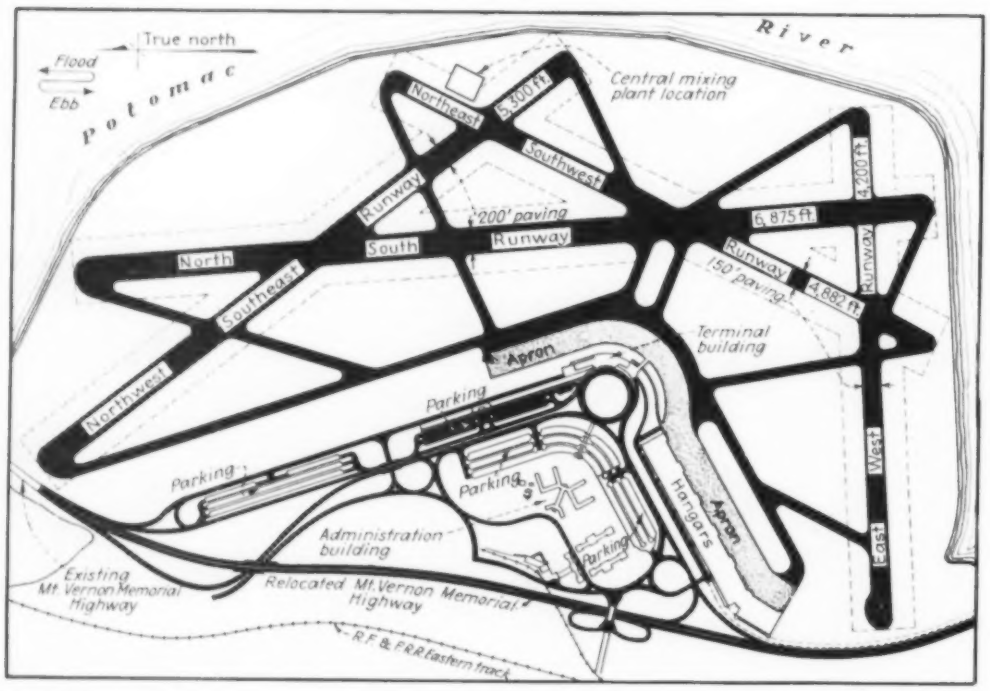
TOPPING OUT OF FORT PECK DAM. U. S. Engineer Department project on Missouri River in Montana, is under way. Using four 22-cu.yd. and one 20-cu.yd. tractor-hauled carryall scrapers J. A. Terteling & Sons, contractors of Boise, Idaho, bring huge earth structure to ultimate height of 250 ft.





TWO BLACK TOP PAVING SPREADERS lay asphaltic concrete binder course and wearing course in 10-ft. lanes on runways 150 to 200 ft. wide of Washington National Airport.

Washington Airport Runways USE LOCAL AGGREGATES FOR Asphalt Pavement



PAVING CONTRACT at Washington National Airport calls for placing 450,000 sq.yd. of 3½-in. hot-mixed hot-laid asphaltic concrete in two courses on runways, main taxiways and aprons in 130 calendar days ending Sept. 11, with remaining additional pavement on about 225,000 sq.yd. to be placed at more leisurely pace.

DURING THE MONTHS while 18,000,000 cu.yd. of dredged sand-gravel fill was being pumped into runway areas on the 729-acre site of the Washington National Airport at Gravelly Point, Va., across the Potomac River from Washington, D. C., a special subcommittee of an Interdepartmental Engineering Commission, set up by the Civil Aeronautics Authority to build the airport, made extensive studies and investigations in search of a runway pavement design that would meet the triple requirements of long life, low cost and rapid construction. The subcommittee's work led to selection of a design which makes use of aggregates present in the fill for both a 9-in. stabilized clay-sand-gravel "soil concrete" base and a 3½-in. hot-mixed, hot-laid asphaltic concrete top, the latter placed in two courses.

Acting as cooperating member agencies of the Engineering Commission and of the subcommittee, the Civil Aeronautics Authority is in charge of runway design, while the Public Roads Administration takes care of materials tests and inspection and the U. S. Engineers direct construction. Stabilization of 9-in. base by a WPA force at the rate of 20,000 sq.yd. per week was described in *Construction Methods* last month. On stabilized and primed portions of the base, two-course construction of the 3½-in. asphaltic concrete surface now is going ahead at a rate of 1,500 tons per day on a three-shift schedule of the Warren Bros. Roads Co., Boston, con-

tractor. A central mixing plant equipped with a 5,000-lb.-capacity mixer produces the asphaltic concrete, which is laid in 10-ft. lanes for the binder course and wearing course by two self-propelled black top paving machines.

Runway Paving Costs — Compacted and primed 9-in. stabilized base is constructed at a cost of 50c. per square yard with the aid of heavy tractor-drawn plows, cultivators and disk harrows which make it possible to mix the

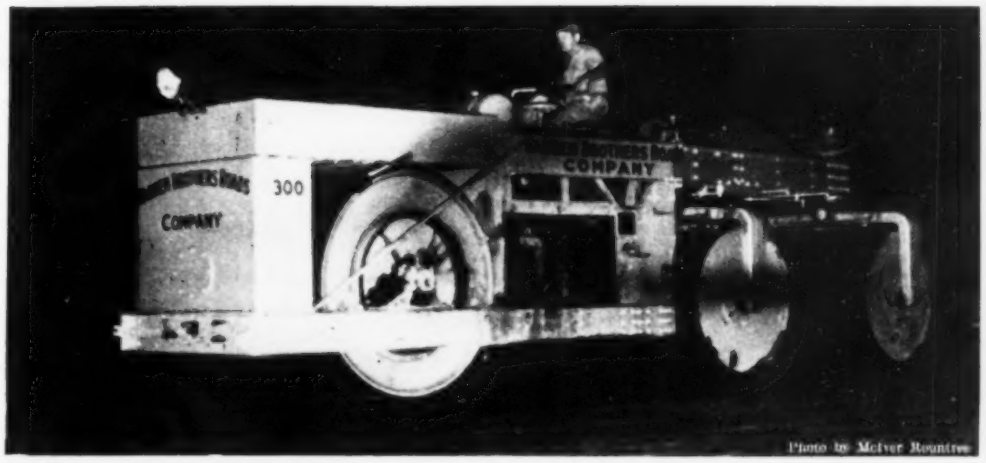
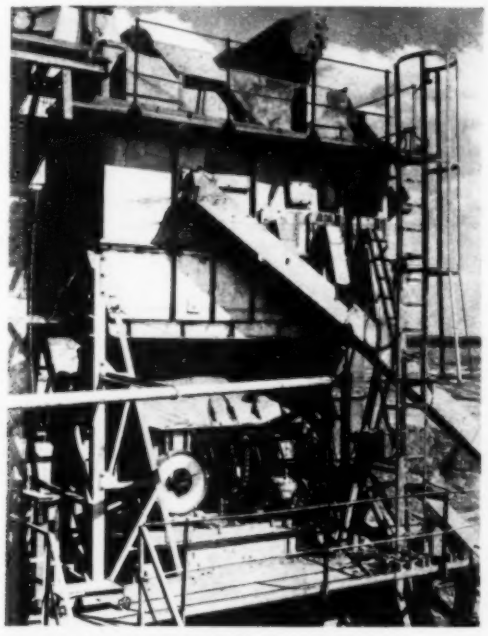
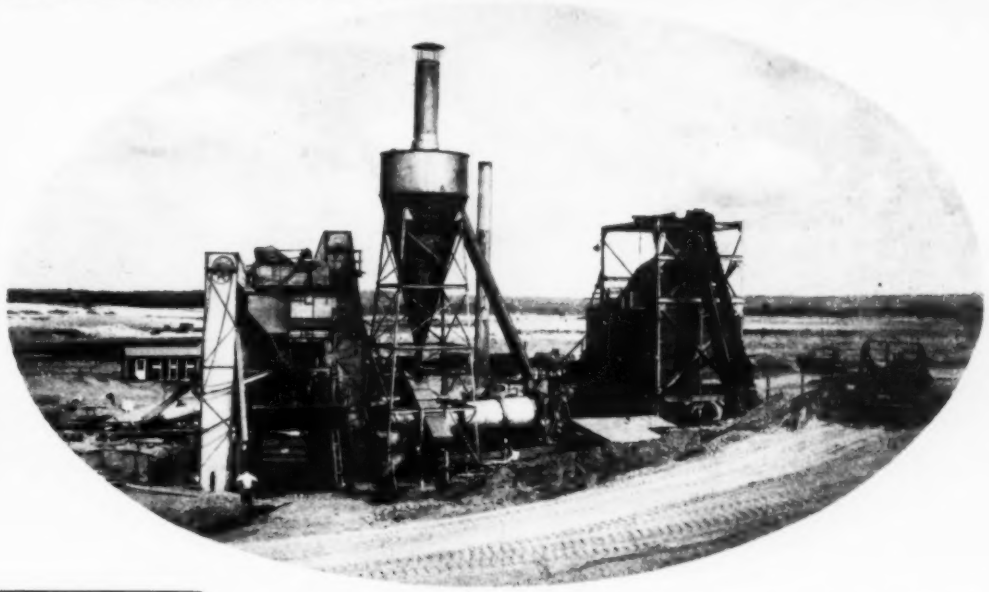


Photo by McIver Rountree

THREE SHIFTS FOR THREE WHEELS of this triple-axle tandem roller, which compacts and irons binder and wearing courses for 21 hr. out of each 24.



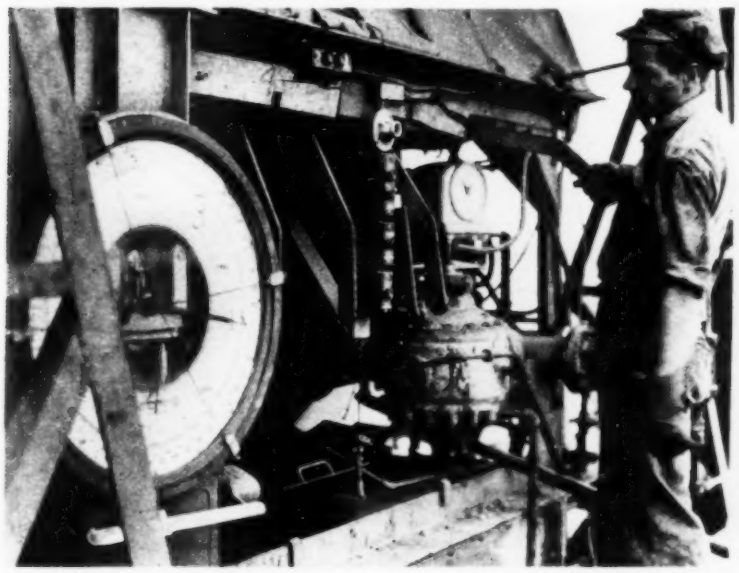
OPERATOR'S PLATFORM of asphalt mixing plant has push buttons, levers and dial scale in convenient positions for observation and use.



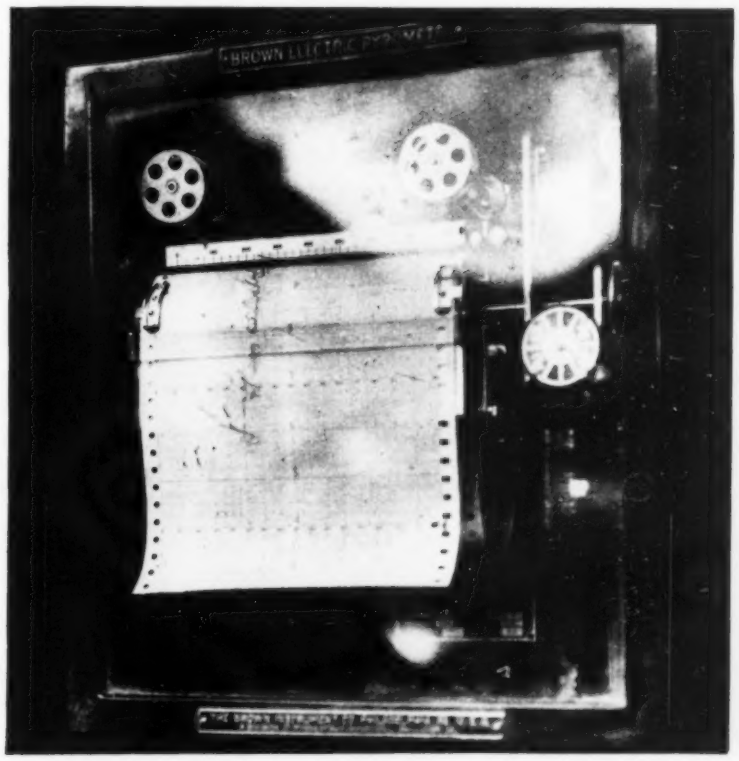
ASPHALT PLANT takes aggregates from processing plant, at right, and dries and classifies them before mixing with asphalt in twin pugmill unit of 5,000-lb. capacity designed to meet specified production requirements. Truck under mixer is being loaded with three 5,000-lb. batches.



RUNWAY CROSS-SECTION comprises 9-in. "soil concrete" base of stabilized clay-sand-gravel primed with tar and surfaced with two courses of asphaltic concrete having average total thickness of 3½ in. Both stabilized base and asphaltic concrete top utilize aggregates from airport hydraulic fill.



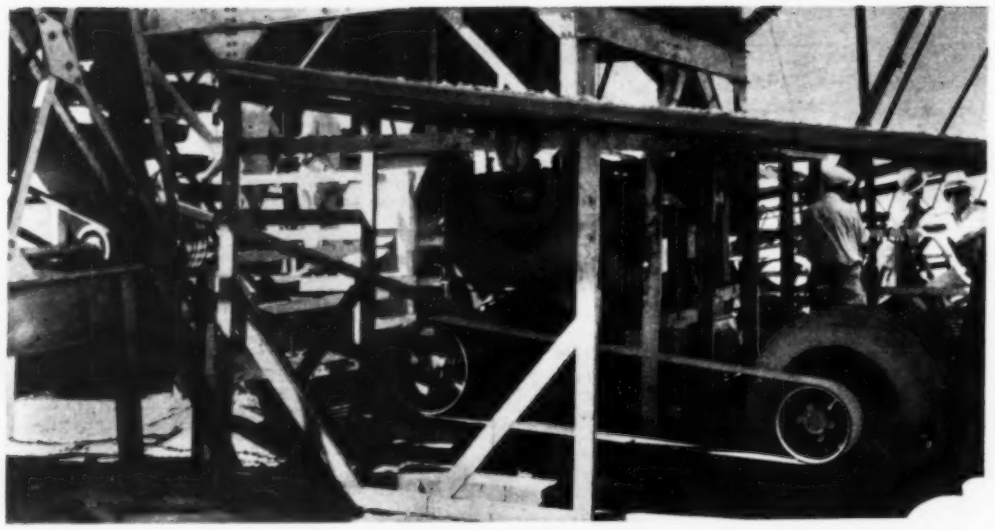
AS OPERATOR MANIPULATES gate levers, dial scale registers cumulative weights of aggregates for binder course mixture.



RECORDING PYROMETER makes graphic record of temperatures in asphalt tanks, in boot of hot elevator and in weigh box, graphs being drawn in inks of three different colors.



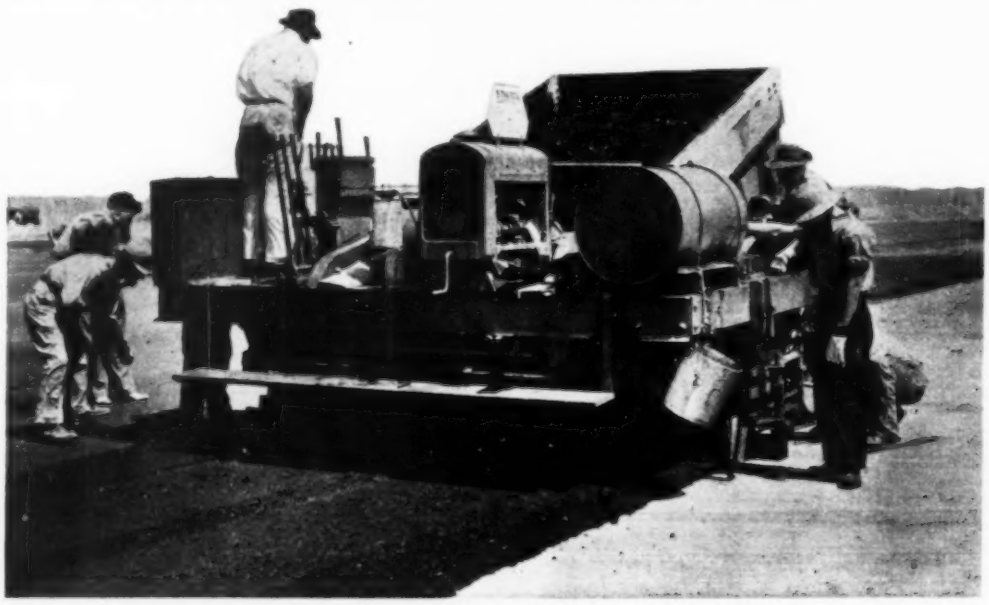
80,000 TONS of hot-mixed, hot-laid asphaltic concrete are being produced and placed in 130 calendar days for Warren Bros. Roads Co. by H. W. MAKEMSON (right), superintendent, and E. M. PEARSON, plant superintendent.



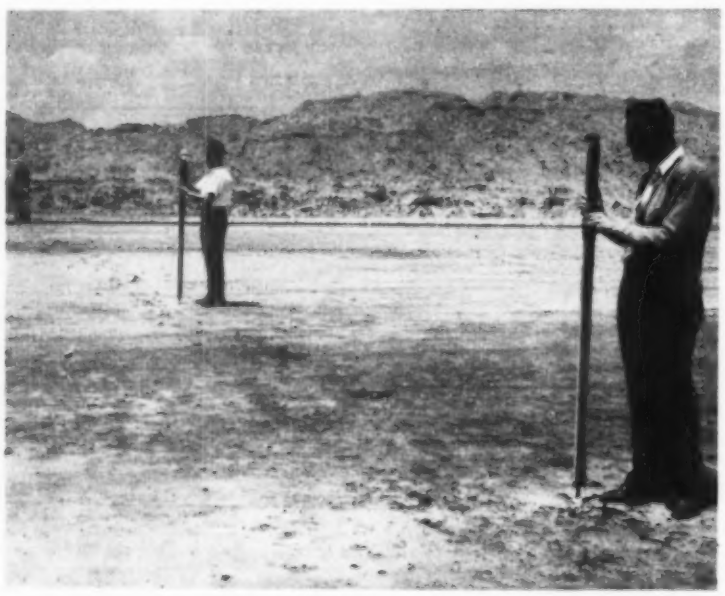
DIESEL ENGINE of 125-maximum-b.hp.-rating drives drier, cold and hot elevators and 30-kw. electric generator supplying power to vibratory pan feeders and to asphalt plant screen.

sand, gravel and binder soil to a loose depth of 12 in. or more. On the primed base, 3½-in. asphaltic concrete top is being placed in two courses at a cost of 47½c. per square yard, exclusive of engineering and inspection, plus a WPA common labor cost of 12½c., making the overall unit construction cost of runway pavement equal to $1.10 per square yard. With regard to the bituminous construction, awarded on a competitive basis, it is interesting to note that the bid prices of the second, third and fourth bidders, all closely grouped, for the hot-mix, hot-laid asphaltic concrete averaged more than 20 per cent less than the estimated cost of mixed-in-

(Continued on page 80)



SELF-PROPELLED SPREADER AND FINISHER lays binder course as it pushes ahead truck discharging hot mixture into hopper of machine.



WITH GRADES SET BY INSTRUMENT at points on only two lines (center line of runway and outside form line) engineers set intermediate grade pins for 10-ft. lanes with aid of telescope eyepiece of 2 to 4 magnification and pair of targets marked with horizontal lines as shown, all three tools being mounted on poles of equal height. By placing telescope on center-line pin and broader target on outside pin, all intermediate pins can be checked to grade on straight 1 per cent slope by sighting through eyepiece until horizontal lines of two targets coincide. Same method serves to check top course of pavement as it is laid.

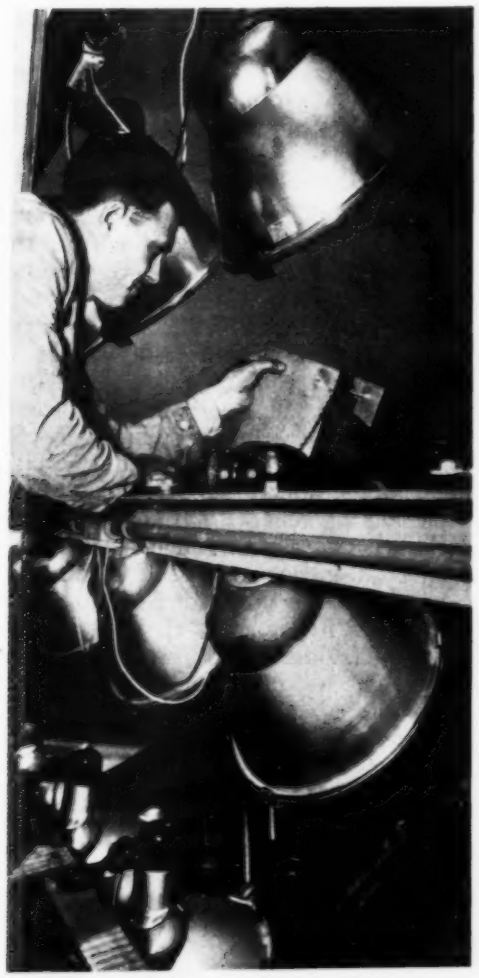


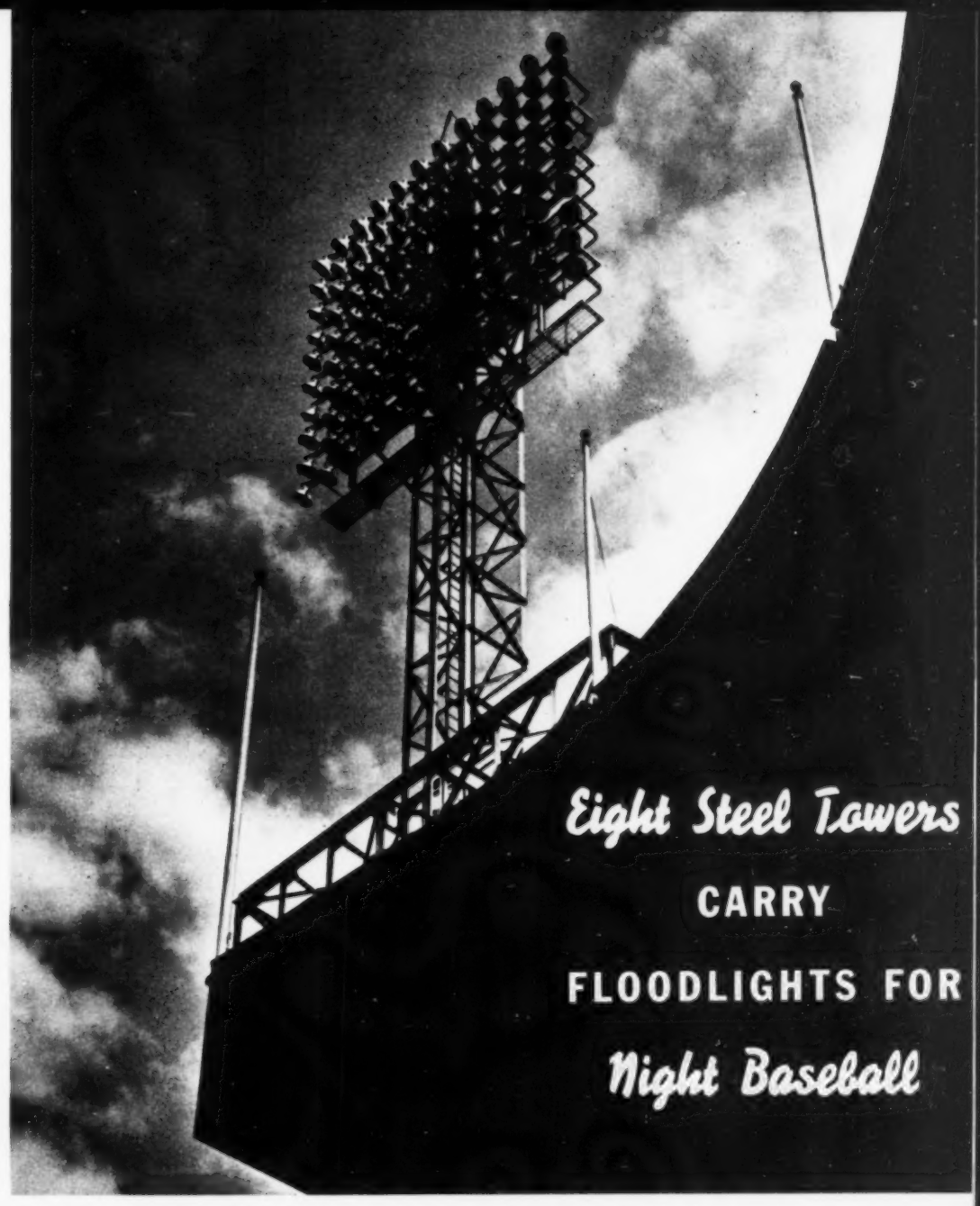
BLACK TOP goes down during black hours of third shift, as trucks deliver hot mix to two spreading and finishing machines. Contractor's plant is organized to average 500 tons per shift, or 1,500 tons per day.

EIGHT TALL STEEL TOWERS erected to support a battery of 836 individual floodlights mounted on cross-arms have made the Polo Grounds in New York City, home of the New York Giants of the National Baseball League, the world's most brilliantly lighted night baseball park. The towers are mounted on the grandstand, with their tops about 150 ft. above the level of the playing field. The lighting system, designed and furnished by Westinghouse, uses a total of 200,000,000 candlepower to turn night into day.

The illumination level over the field is not uniform, but varies to suit baseball requirements. Because of the concentration of play and the greater speed of both ball and runners in the infield, more lights are focused on this area than anywhere else. Two floodlights are trained on the pitchers mound, two more

(Continued on page 90)



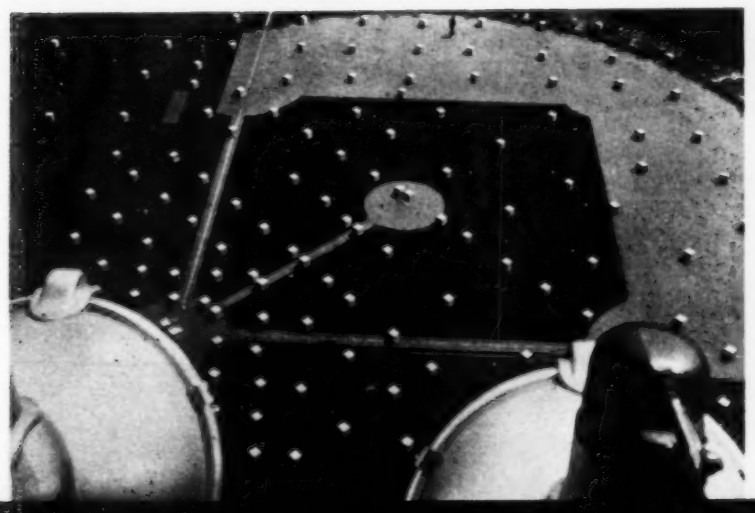


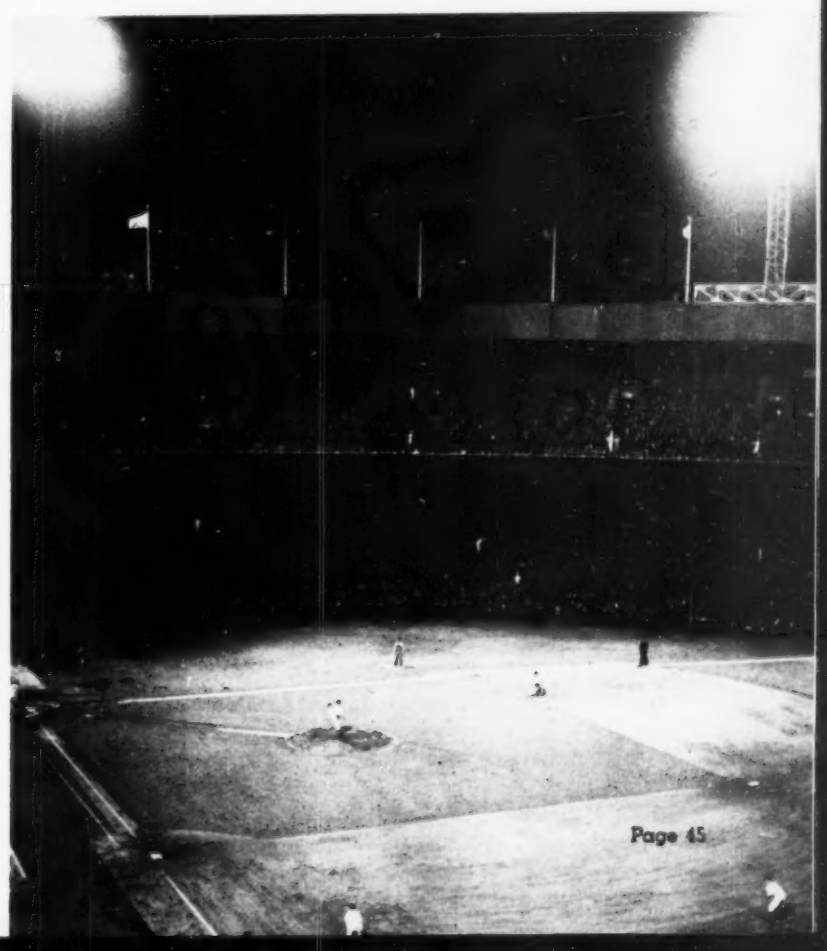
MOUNTED ATOP GRANDSTAND, steel tower, 150 ft. above playing field, carries cross-arms on which battery of floodlights is mounted.

FIRST GAME (below) at Polo Grounds is played under artificial light May 24, when New York Giants met Boston Bees.

ADJUSTMENT OF EACH FLOODLIGHT (left) on tower is made by Harry M. Hays, Westinghouse engineer, using rifle sights to adjust lights with mathematical precision.

BOXES (below), placed at predetermined spots on field, were used as targets for adjusting each of the 836 floodlights in 200,000,000 candlepower system.







DISINTEGRATED CONCRETE on viaduct roadway and in expansion is cut out and replaced.



BRACKETS supporting viaduct sidewalks show damage of concrete calling for repair.

Traveling Scaffold HELPS REPAIR LONG CONCRETE VIADUCT

A SPECIAL TRAVELING STEEL SCAFFOLD providing a working platform on the under side of the structure for cutting out and replacing disintegrated concrete aided WPA forces in making extensive repairs to the North Hill viaduct in Akron, Ohio, a multiple-arch structure of concrete 2,840 ft. long which, since its completion in 1922, had been severely damaged as a result of leaking expansion joints, infiltration of surface water and lack of general maintenance work. Comprising 16 concrete arches and 2 beam-and-girder approach spans, the viaduct crosses the Little Cuyahoga River with a five-lane, 52-ft. roadway and two 10-ft. sidewalks 130 ft. above water level. The leaking bitumen-filled expansion joints had to be replaced with sliding plates attached with bronze bolts, while defective roadway slabs had to be removed and repoured with dense new concrete of 1:5 mix. Many of the reinforced concrete brackets carrying sidewalk slabs had to be removed or rebuilt. The repair work involved extensive use of concrete applied by the cement gun method and reinforced



SIXTEEN CONCRETE ARCHES (right) support viaduct which has total length of 2,840 ft., crossing B.&O. R.R. tracks and Little Cuyahoga River with five-lane roadway.



EXPANSION JOINTS, suffering from seepage of water, had to be cut out and replaced.



TRAVELING STEEL SCAFFOLD, moving on bridge deck, is heavily counterweighted to support overhang which carries working platform extending underneath roadway.

with wire mesh. The approximate cost of the bridge rehabilitation job was $570,000.

In replacing the deteriorated concrete, the precast concrete hand rail was removed, the west traffic lane beginning at the south end of the bridge was closed to traffic, a temporary guard rail was erected and the work of reconstruction began. A traveling steel scaffold was designed to move on rails on the sidewalk slab, with a concrete counterweight carried on the roadway slab next to the curb. This traveling scaffold, designed to carry a live load of 15,000 lb., allowed workmen to reach parts of the structure underneath the sidewalk and deck slabs which had to be chipped out. Then new steel was placed and the sections rebuilt with pressure concrete applied by cement gun. This part of the work included the chipping out and rebuilding of the sidewalk brackets, spandrels, columns and deck beams. The average thickness of Gunite used in replacement of beam brackets and other parts needing repair had been 3 in.; this thickness varied from as much as 6 in. to as little as 1 in. The traveling scaffold was completely protected with 4-in. wire mesh, since safety regulations of WPA demand that all scaffold be designed to make it impossible for



ANOTHER TYPE of suspended scaffold which reaches under bridge deck to carry platform for repair work.



any workman to fall. The mesh also safeguards the public underneath from any falling pieces of concrete chipped off in the process of cutting out deteriorated sections.

A second type of suspended scaffold also was used for repairing the roadway slab between the arch ring and the viaduct center line. It was supported by cable through holes drilled in the deck slab.

The work on top of the viaduct roadway consisted of cutting through the old slab, completely cutting out the side-



WOOD FORMS are being placed to receive new concrete for viaduct roadway

walk slab and as far down on the brackets as the resident engineer deemed necessary to reach sound concrete. It was found that the deck slab was in good condition at an average distance of 6 ft. from the curb. New steel was welded in place and the section was rebuilt by concrete applied by cement gun.

The sidewalk brackets then were rebuilt to original design and a complete new sidewalk slab placed. A copper and steel expansion joint was used next to the rebuilt curb in order to waterproof the deck slab. Carried along with the curb was an elevated 6x8-in. curb rail for protection to traffic. The original curb was only 6 in. high and several automobiles during icy weather had jumped it, breaking out parts of the hand rail.

Sidewalk and deck slab forms were fabricated on the ground and hoisted into place, later to be secured by eyebolts and rods through the deck slab supported on steel I-beams. The forms were disassembled in the same manner and brought ahead to the next bay by the use of slings.

A new type of hand steel rail was designed, prefabricated in panels and bolted to the sidewalk slab. At each expansion joint and in every half bay a new concrete post was placed in which the steel hand rail is anchored.

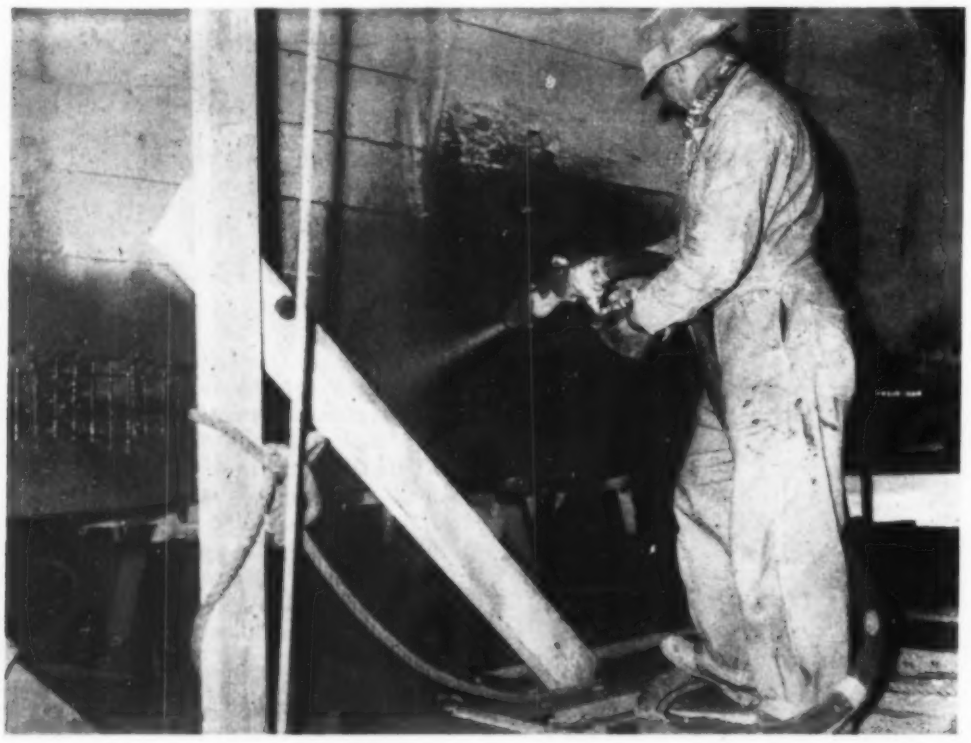
All of the construction methods used had to be developed after parts of the structure had been wrecked, since there was no possible way in which a determination could be made of the extent of the damage to the structure until all of the disintegrated concrete had been removed and the extent of the damage area was determined.

The work of cutting out portions of the slab and beams was done with air tools and at times so much of the structure was removed that it was dangerous for the workmen. As a safety precaution each man wore a safety harness, similar to a parachute harness, to which was attached a 10-ft. length of ¾-in. rope which then was attached to some permanent portion of the structure.



SAFETY REGULATIONS (right) required workers to wear harness with rope attached to prevent injury from falls.

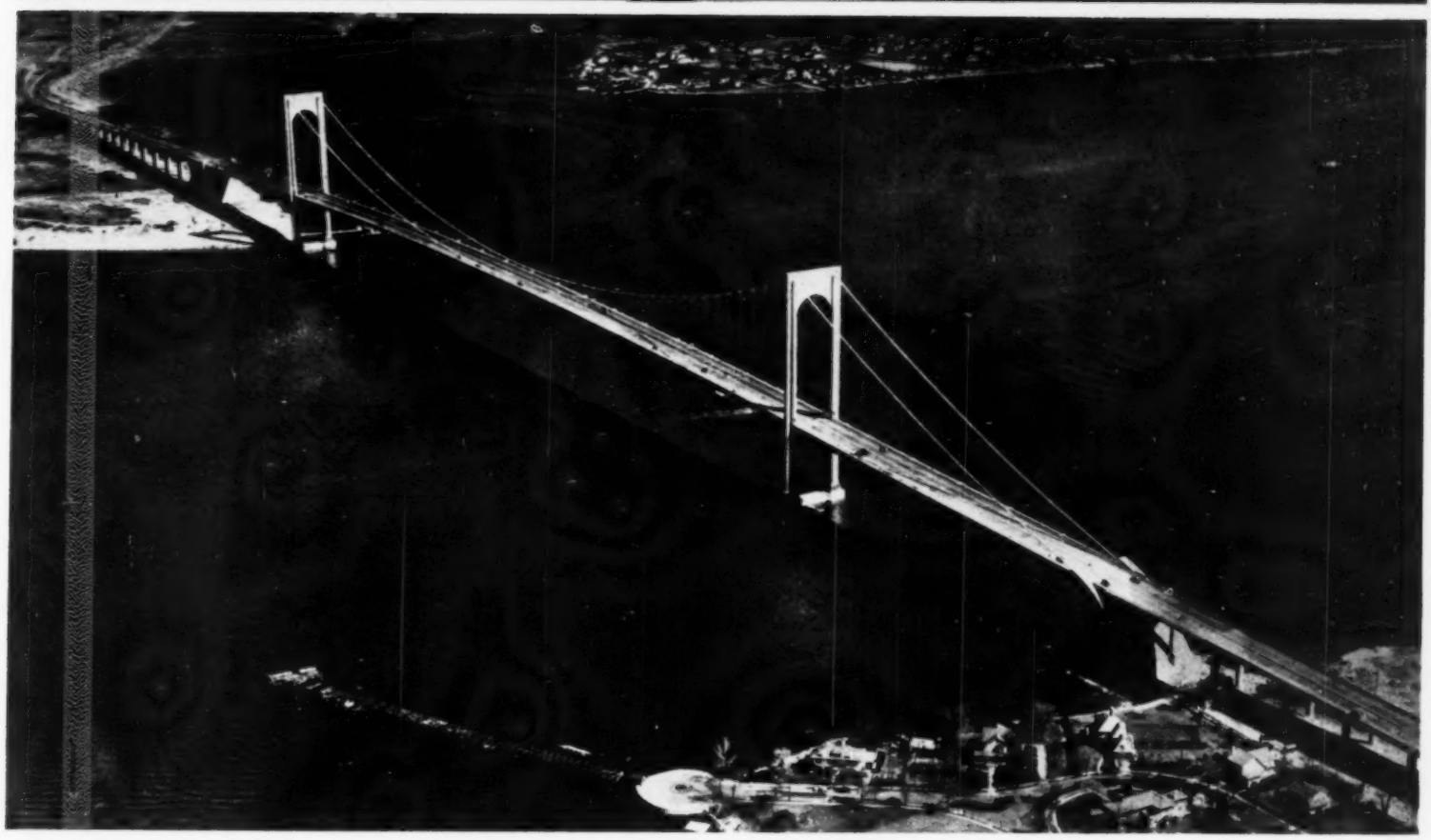
CEMENT GUN (below) applies new coating on wire mesh reinforcement to replace disintegrated concrete.



For repair work on the top of the viaduct roadway the main items of construction plant included two portable two-stage air compressors, 16 paving breakers, 2 rock drills and cement gun equipment. For the under-deck operations the crew used two air compressors, cement gun, sand blasting equipment to clean steel, 10 air-operated chipping hammers, 2 rock drills for anchor-bolt holes and small paint spray outfits.

For the Work Projects Administration on the Akron viaduct repair project Charles R. Sharp was district engineer, E. Lloyd, area engineer and S. C. Breen superintendent. Summitt County was represented by Arthur F. Ranney, county engineer.

STEEL BRIDGES WIN *Beauty Awards*

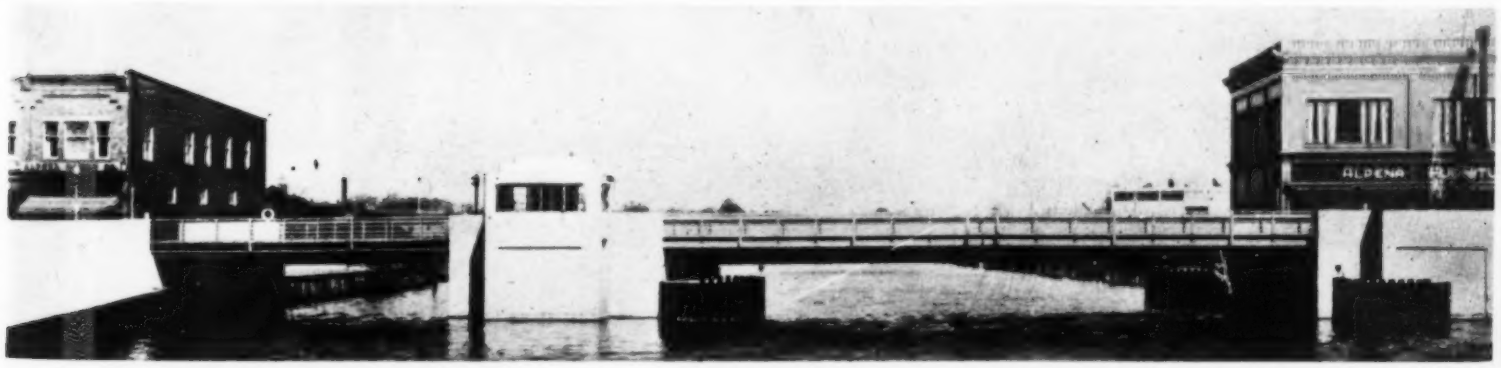


MONUMENTAL CLASS — BRONX-WHITESTONE BRIDGE. Crosses East River, New York City. Total cost, $10,000,000. Total length, 8,000 ft., including approach viaducts; main suspension span, 2,300 ft.; side spans, 735 ft. each. Engineers, Triborough Bridge Authority, O. H. Ammann, chief engineer; Allston Dana, engineer of design; Leon S. Moisseiff, consulting engineer; Aymar Embury, architect; Madigan-Hyland, consulting construction engineers; Col. H. W. Hudson, engineer of construction. Fabricators, American Bridge Co.

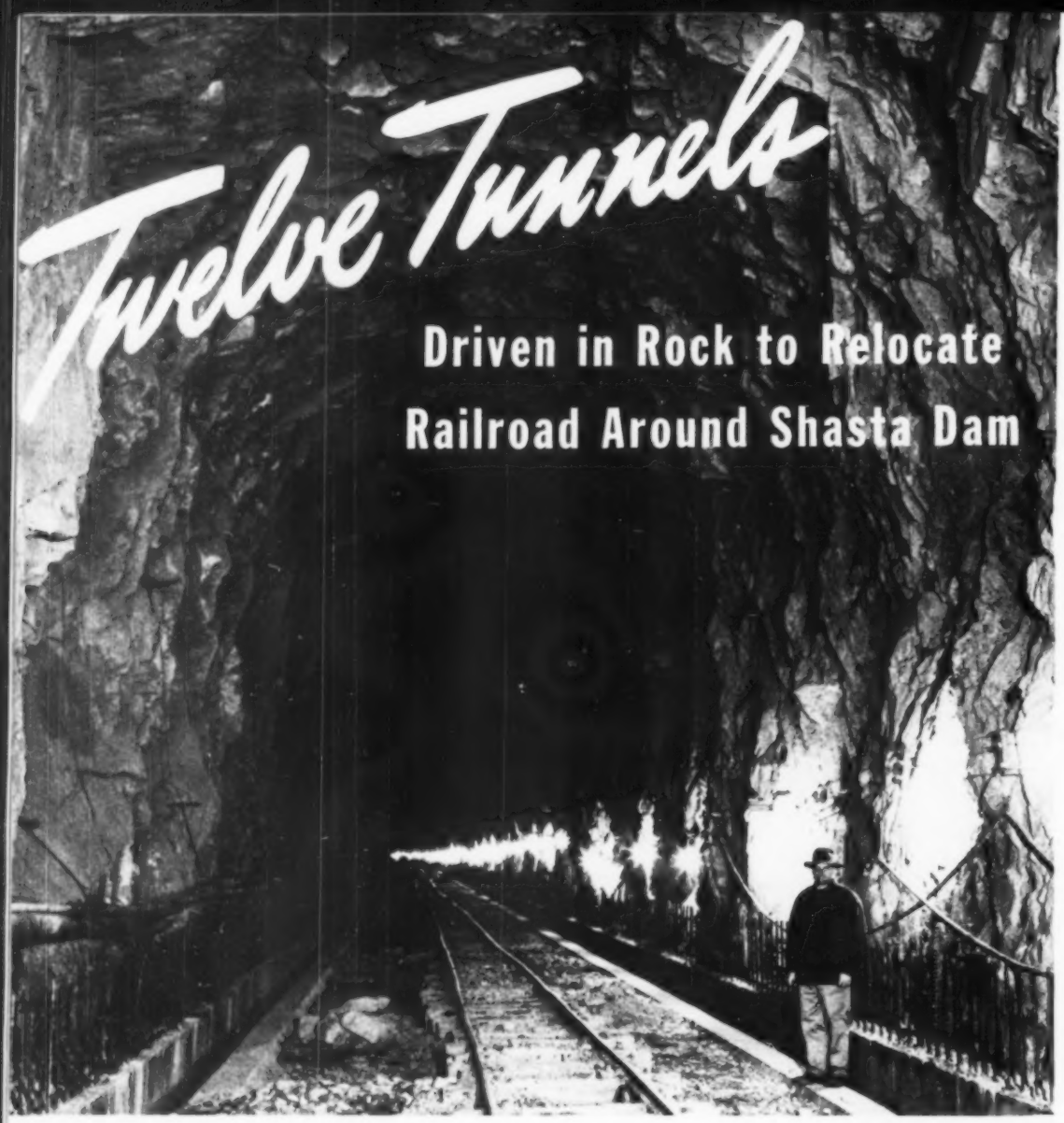
FOR THE MOST BEAUTIFUL STEEL BRIDGES built and opened to traffic during 1939, the American Institute of Steel Construction on June 20 announced its Twelfth Annual Awards. Selections in three classifications—monumental ($1,000,000 or more); small, (less than $250,000) and movable — were made by a jury comprising Prof. Hale Sutherland, Lehigh University; Prof. J. K. Finch, Columbia University; Francis Keally and Louis E. Jallade, New York architects; and Roger W. Sherman, of "Architectural Record."



SMALL BRIDGE CLASS — VALLEY RIVER FOOT BRIDGE. Located at Murphy, N. C. Total cost, $6,000. Span lengths, 52, 78 and 52 ft. Engineers, Tennessee Valley Authority, T. B. Parker, chief engineer, H. A. Hageman, designing engineer, F. W. Webster, highway engineer, Erwin Harsch, structural engineer. Fabricators, Lloyd E. Jones Co.



MOVABLE BRIDGE CLASS — SECOND AVE. BRIDGE. Located over Thunder Bay River, Alpena, Mich. Total cost, $289,000. Double-leaf bascule of 127 ft. span; approach span, 49 ft. Engineer, Clifford E. Paine. Fabricators, R. C. Mahon Co.



Twelve Tunnels

Driven in Rock to Relocate Railroad Around Shasta Dam

Operations Under Four Contracts Employ Both Full-Face and Top-Heading and Bench Methods

By JOHN P. DENSMORE and ROBERT A. MIDTHUN
Principal Inspector *Senior Photographer*
U.S. Bureau of Reclamation, Redding, Calif.

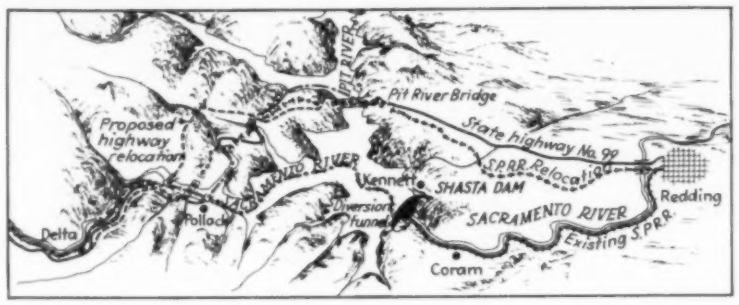
Photos by
U. S. BUREAU OF RECLAMATION

TWELVE TUNNELS and eight major bridges are involved in relocating 37 mi. of the Southern Pacific Railroad around the site of the reservoir which will be created by Shasta dam, 12 mi. above Redding, Calif., key feature of the U. S. Bureau of Reclamation's Central Valley project now under construction to conserve and better distribute the waters of the Sacramento and San Joaquin rivers in the two great semi-arid interior valleys of California. The relocated railroad is 30 mi. long, eliminating 7 mi. of distance and more than 5,000 deg. of curvature on the Shasta route between San Francisco and Portland, Ore.

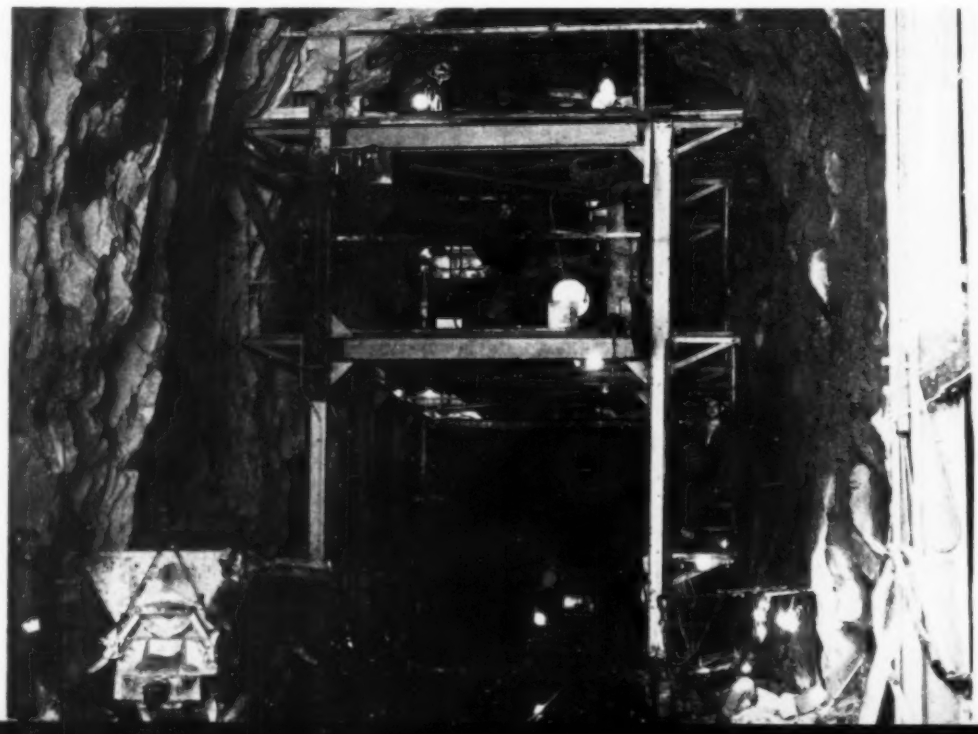
The railroad relocation begins at Redding, where the first of four crossings of the Sacramento River is made. It proceeds generally northward for 14 mi. through the hills east of the present canyon route to gain an elevation above the high water level of the future reservoir, then passes through the first two of the twelve tunnels, and crosses the Pit River on the world's highest double-decked rail and vehicular bridge. From that point the railroad follows a ridge passing through rugged country requiring eight more tunnels and two more bridges, to the vicinity of Pollock where it crosses the Sacramento River a second time, skirts the reservoir area on the west side of the canyon and crosses Doney Creek, a tributary stream. Approaching the northerly end of the relocation in the vicinity of Delta Station, the new line crosses the Sacramento River a third time, passes through the last two

TYPICAL UNSUPPORTED SECTION (left) of tunnel No. 2 showing character of rock. Curbs and gutters have been placed in preparation for lining sidewalls and arch. This is second longest of 12 tunnels in railroad relocation at Shasta dam, being 2,691 ft. in length.

Fig. 5 . . . **RAILROAD RELOCATION (below)** of Southern Pacific line is 30 mi. long between Redding and Delta, saving 7 mi. of distance of existing route.



STEEL JUMBO (below) mounts drills for full-face headings of tunnels Nos. 1 and 2. Bottom deck of jumbo has been removed to permit passage of muck trains. Hoist arrangement, at left rear of jumbo, permits switching of muck cars.





FULL-FACE DRILLING JUMBO has three operating decks and carries eight drifter drills, two at each deck and two at ground level. These full-face jumbos were used in tunnels Nos. 1 and 2.

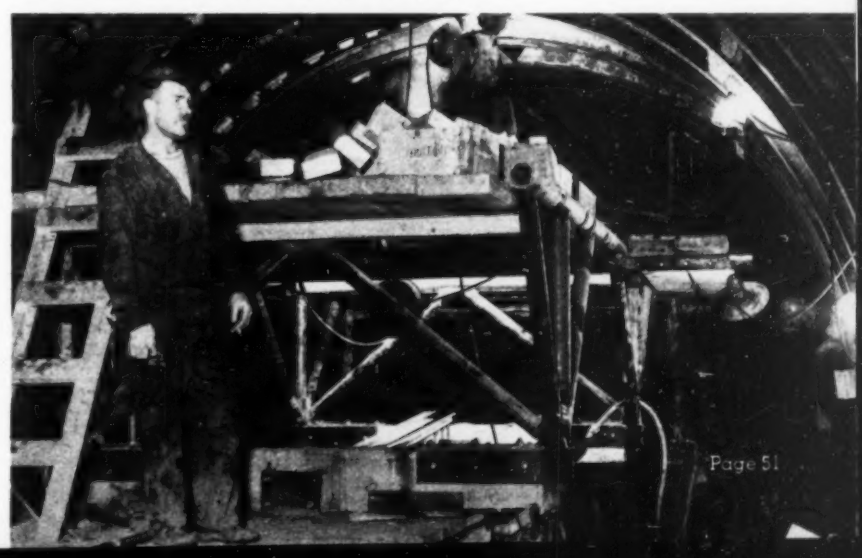


NATURE OF TERRAIN through which 12 tunnels are driven is illustrated by this view, with portal of tunnel No. 1, more than ½-mi. long, in background. On track in foreground in open cut leading to tunnel No. 2 is full-face drilling jumbo.Material excavated from tunnels is placed to form roadbed fill between two tunnels.



TYPICAL DRILL MOUNTING on full-face jumbo used in tunnels Nos. 1 and 2. Provisions are made for eight drills at tunnel face, two on each of three decks and two at ground level. This drill is operating from second deck.

TYPICAL JUMBO FOR DRILLING TOP HEADING (below) and bench faces when tunnels were excavated by that method. Jumbo is mounted on two flat cars and provides one working deck above ground level. Two drills are mounted above deck and two at ground level.



tunnels and across the fourth Sacramento River bridge, rejoining the existing tracks above the headwaters of the reservoir.

The 12 tunnels have a combined length of more than 3½ mi. and are located within the northerly 16 mi. of the railroad relocation. Individual tunnels vary in length from 745 ft. for tunnel No. 6 to 2,715 ft. for tunnel No. 1.

Owing to the rugged nature of the terrain, bids for tunnel work were advertised under six separate schedules covered by four sets of specifications. Final awards to successful low bidders were made under four contracts, each of which included the construction of certain tunnels, earthwork and miscellaneous structures. Twelve additional contracts were awarded for those portions of the relocation not including tunnel construction.

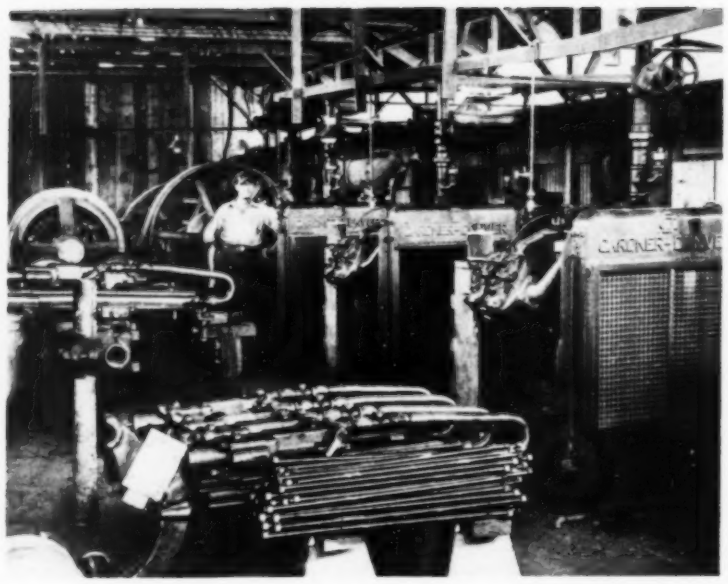
Tunnel Design

The tunnels are of the typical railroad section with semicircular arch roofs and vertical sidewalls. In general, tunnels on tangents and curves of 2 deg. or less have a clear width of 17 ft., and tunnels on curves greater than 2 deg. have a clear width of 18 ft. The normal height between sub-grade and spring line is 16 ft. 10¾ in., but, in the longer tunnels, this distance was increased to 18 ft. 4¾ in. to provide better ventilation. Tunnel No. 2, although located on a tangent and 1-deg. curve, is 18 ft. wide to provide clearance for a gauntlet track.

All tunnels are being lined on the sidewalls and arches with concrete having a minimum thickness of 12 in. inside the steel supports, or, in the unsupported sections, inside the A-line,



IN ESTABLISHING TOP HEADING first step in gaining access to firm ground is accomplished by pioneering two 5x7-ft. drifts at elevation of wall plates, one drift on each side of portal. Drifts are later cross-cut and rimmed out to permit installation of wall plates and arch ribs after which core thus inclosed is removed. Suitable ground usually was encountered after progressing 40 to 50 ft.



COMPRESSOR PLANT at tunnel No. 10 having a capacity of 3,920 cu.ft. per min. at pres ure of 115 lb. per sq. in. Air is supplied to both headings of this tunnel by 5-in. diameter air lines.

with the exception of a 2,000-ft. section of tunnel No. 1 where the ground was exceptionally good and the lining was reduced to a minimum thickness of 6 in. inside the A-line. The A-line, in a typical tunnel section, is defined as the line within which no unexcavated material of any kind or supports other than permanent steel supports for the sides, roofs, or other parts of the tunnel shall be permitted to remain.

Steel supports were made up from 8-in., 34.3-lb. H-beams. Arch ribs, extending 3 ft. below the spring line to provide more headroom for excavating by the top-heading and bench method, are supported on either side of the tunnel by 8-in. wall plates of the same specifications. Similarly, 8-in. H-beams are used for plumb posts to support the wall plates. Steel supports are installed and spaced under direction of the U. S. Bureau of Reclamation according to the nature of the ground. To date, spacing of supports varies from centers of 2 to 5 ft. Steel supports were used practically the entire



SECOND STEP (above) in gaining access to firm ground for top heading was accomplished by cross-cutting between pair of 5x7-ft. pioneer drifts and installing steel supports. Core beneath steel supports is next excavated and heading is carried forward by ordinary methods.

HOLING THROUGH (below) of top heading of tunnel No. 11 at 6:30 P. M., June 9, 1939, enables Walker "Jack" Nelson to congratulate Shift Boss Eric Pearson. This was first of 12 railroad tunnels to be holed through on Shasta relocation.





TYPICAL SUPPORTED SECTION of tunnel No. 11 after completion of excavation by top heading and bench method. Arch ribs and wall plates are placed during top heading excavation and plumb posts are set when bench is removed.

lengths of all tunnels except in Numbers 1, 2 and 3, which were supported only for short sections adjacent to the portals.

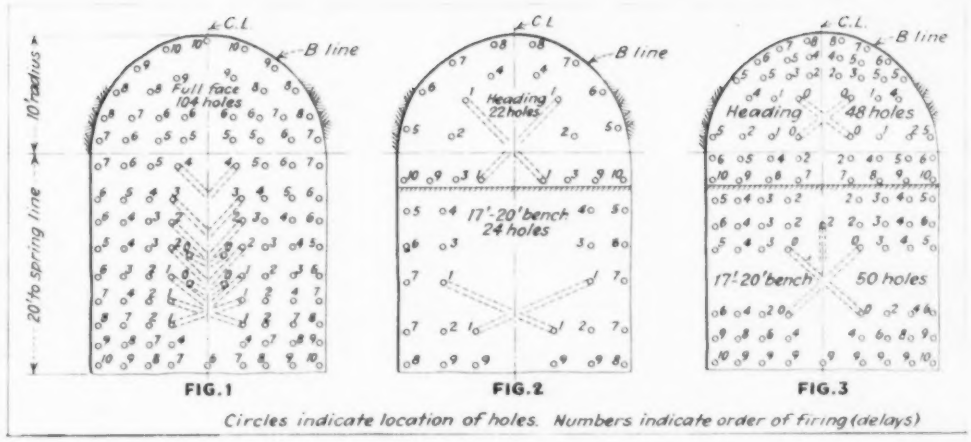
Two of the tunnels were driven by the full-face method while the top-heading and bench method is being used in the other ten tunnels. Accompanying drawings and photographs further describe the methods outlined in this article and illustrate certain construction details.

First Contract—2 Tunnels

The first of the four tunnel contracts, including the driving of tunnel No. 1 which is 2,715 ft. in length and tunnel No. 2 which is 2,691 ft. in length, was awarded to the West Construction Co., of Monrovia, Calif., on a low bid of $904,981. This contractor used the full-face method of excavation, driving one face in each of the two tunnels. The north portal of tunnel No. 1 is located about 750 ft. south of the south portal of tunnel No. 2 and on the opposite side of a gully across which construction of a suitable roadbed fill was required. Material excavated from the tunnels proved satisfactory for the construction of this fill, and being a very convenient location for the tunnel plant, driving operations were carried from these adjacent tunnel faces.

Full-Face Method Used—In order to establish the full-face it was necessary to strip the overburden from the portal and drive two 5x7-ft. drifts at the elevation of the wall plates, one on each side of the tunnel, until firm ground was encountered. When the drifts reached into firm ground, usually in about 40 to 50 ft., crosscutting between these pioneer drifts was started and the tunnel arch

(Continued on page 100)



Figs. 1, 2 and 3 . . . **SPACING OF DRILL HOLES** for driving railroad relocation tunnels in rock under different contracts and conditions.

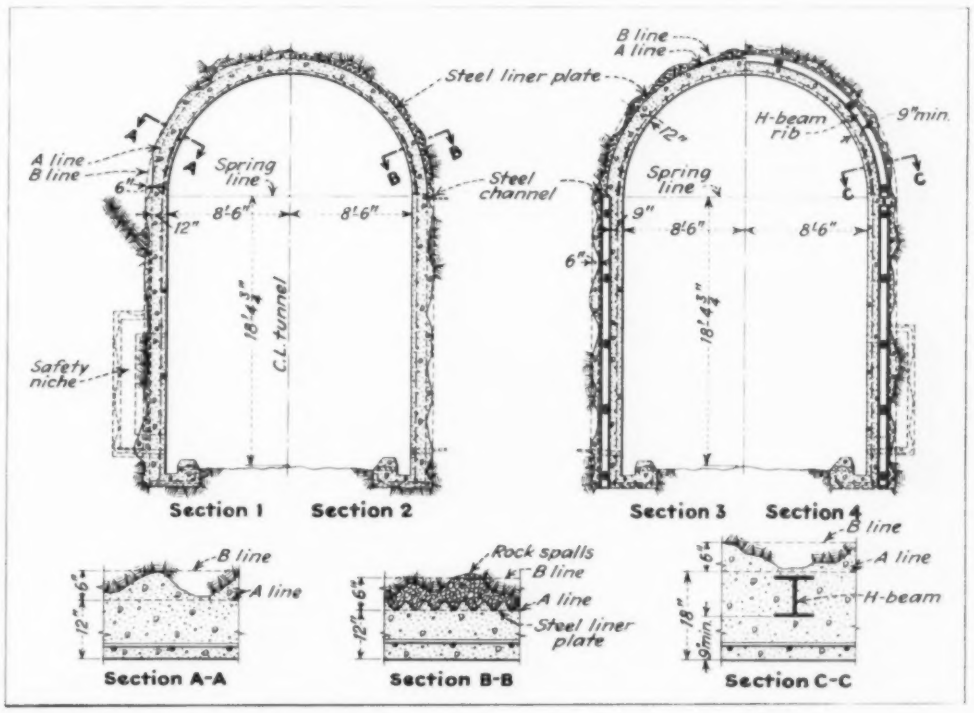
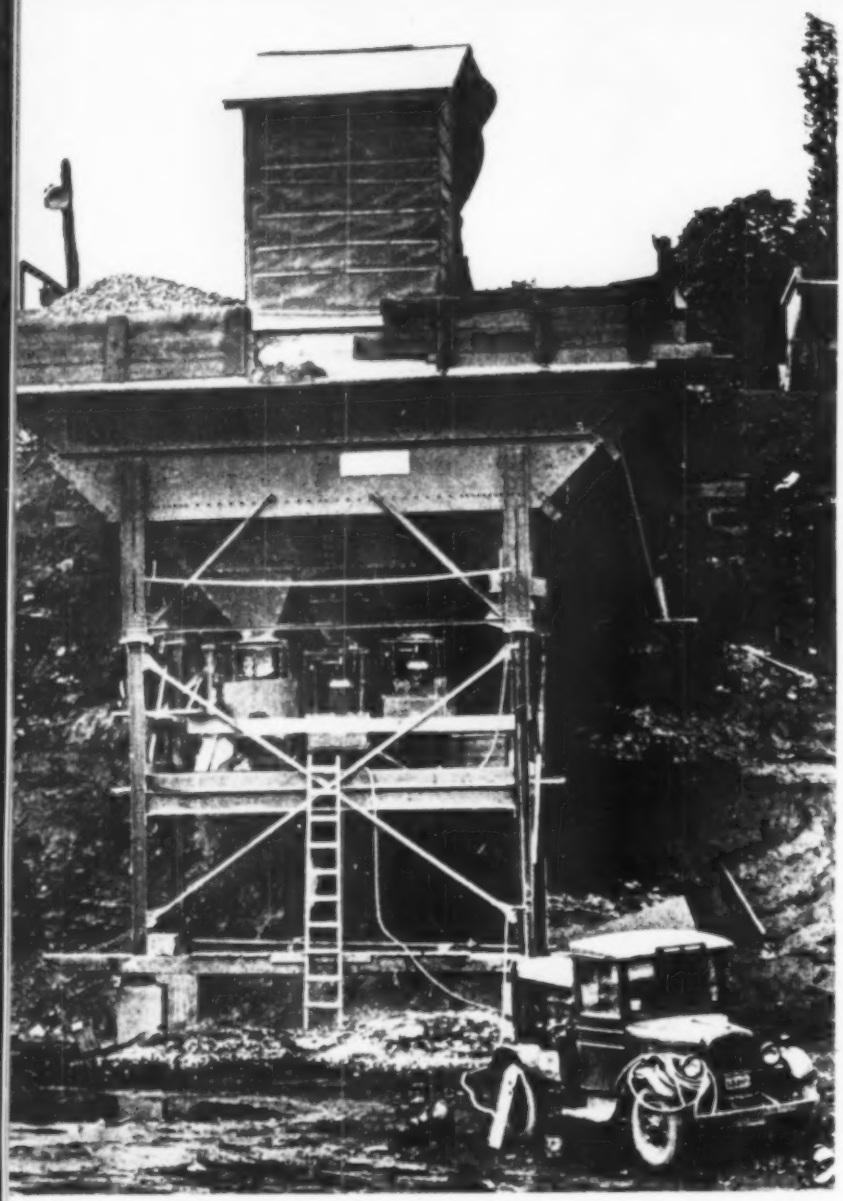
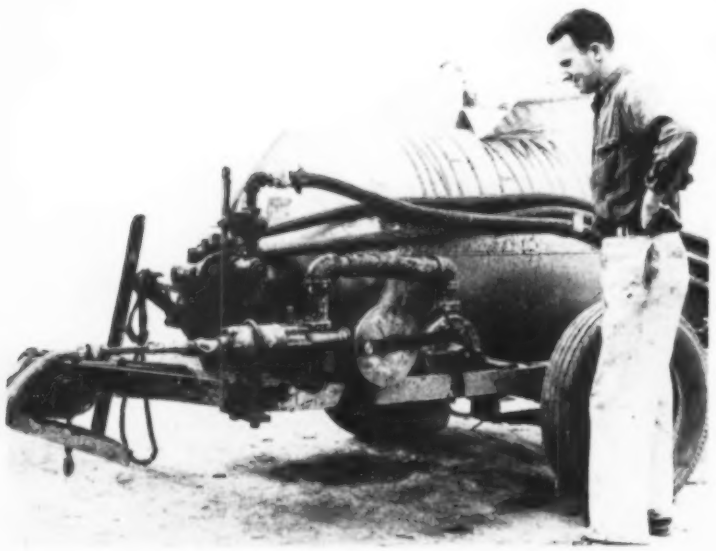


Fig. 4 . . . **TYPICAL CROSS-SECTIONS** of railroad tunnel in rock without timbering and with support in form of steel H-beam bents and plumb posts.

STEEL SUPPORTS (below) protect top heading section of tunnel. Water and compressed air lines are shown at left, while electric power circuits and ventilating air supply are shown at right. Note stub spur track in foreground for switching muck cars during loading operations.



ONE-STOP BATCHING of trucks hauling to two mixers, one 34E dual-drum and one 27E single-drum, on Pennsylvania Turnpike paving contract of Adam Eidemiller, Greensburg, Pa., accelerates batch service and paving speed on this job in contrast to usual method of loading aggregates and cement under separate bins requiring two stops of trucks. Three aggregates and cement are batched through same bin in Johnson plant and are discharged into batch truck simultaneously. Use of four single material batchers and of mix selector weigh beam system to facilitate instant change from 27E to 34E batch enables one plant with two operators to supply two pavers of different sizes. During first few days, plant handles about 110 batches per hour and keeps both pavers going as fast as crews can operate them. Except for manual operation, principles of batching are same as those used in high-production Johnson plants at Grand Coulee, Shasta and other major dam jobs.



IMPROVISED POWER PUMP rigged up by G. L. Malan, machine shop foreman for Pacific Constructors, Inc., at Shasta Dam, utilizes Ingersoll-Rand multi-vane air motor connected to fuel pump by eccentric link and wrench lever to deliver butane from trailer across Sacramento River following bridge washout caused by flood.

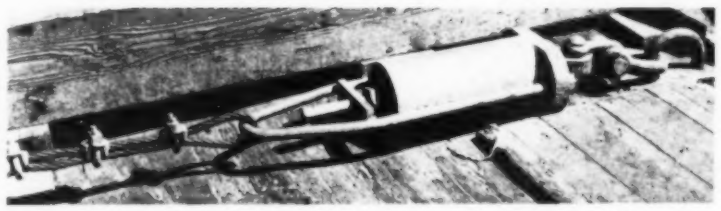


PULLING AND LOADING STUMPS at rate of 125 in 8 hr., Caterpillar 25-hp. diesel tractor equipped with Hyster towing winch and stump-pulling derrick makes rapid progress on land clearing operation near Peterborough, N. H. where Carey Johnson machine removes stumps in wake of logging operations in area which suffered from hurricane of September, 1938.

HOW They Did It

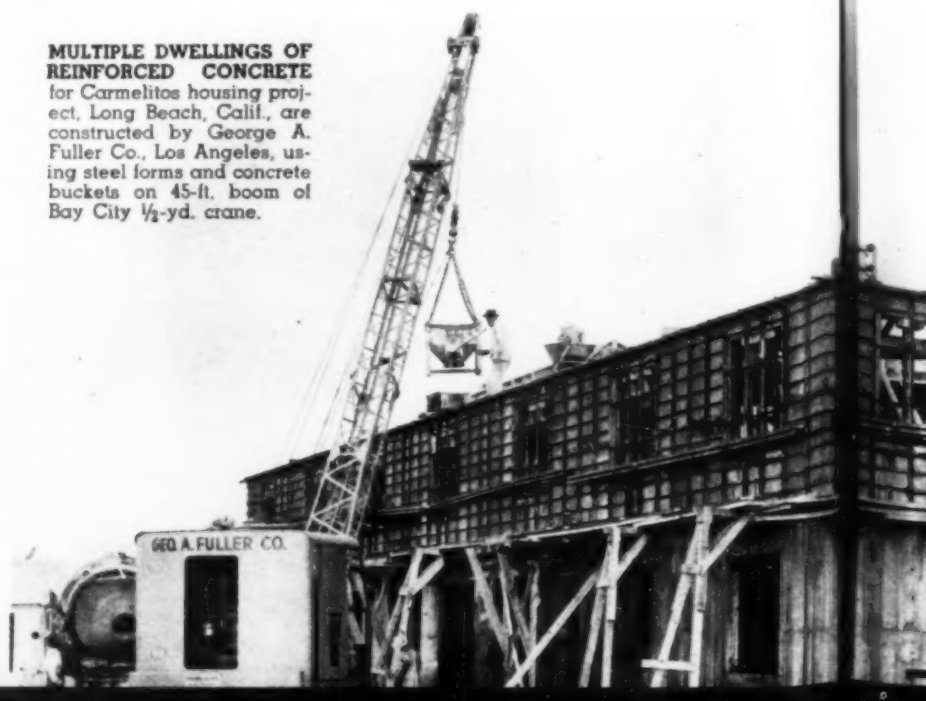
CONSTRUCTION DETAILS

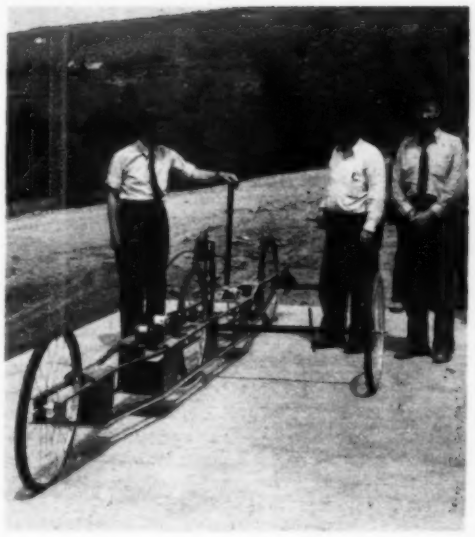
For Superintendents and Foremen



CALIBRATED TENSION INDICATOR containing railroad-car coil spring serves to gage pull on lifting line used by Merritt-Chapman & Scott Corp., New York, in conjunction with other lifting lines to assist in maintaining equilibrium of large four-cylinder caissons during sinking for bridge pier foundations in Potomac River at Ludlow Ferry, Md., 50 mi. below Washington, D. C.

MULTIPLE DWELLINGS OF REINFORCED CONCRETE for Carmelitos housing project, Long Beach, Calif., are constructed by George A. Fuller Co., Los Angeles, using steel forms and concrete buckets on 45-ft. boom of Bay City ½-yd. crane.

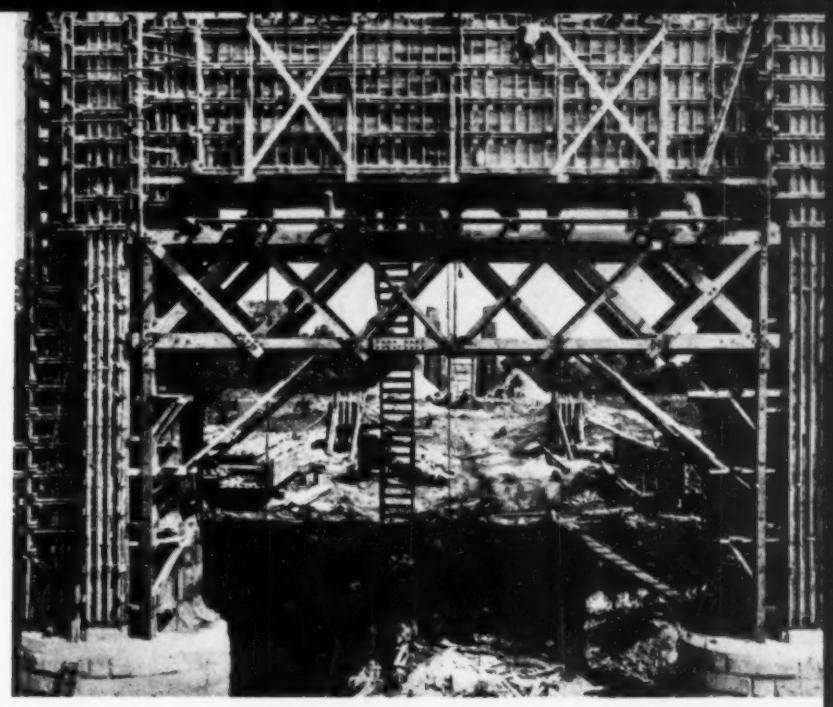




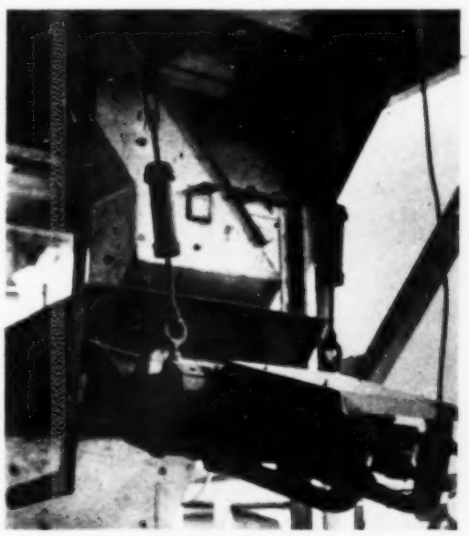
16-FT. PROFILOMETER makes continuous graph of surface smoothness of Pennsylvania Turnpike pavement, built to unusually severe specification of ⅛-in. maximum tolerance in 16 ft., except on vertical curves, where ⅛-in. variation in 10 ft. is permitted. Designed under direction fo Samuel W. Marshall, chief engineer, and Fred S. Poorman, assistant chief engineer, profilometer is operated by E. W. Martin, standing at left ol machine, as closely as possible behind paving mixers, to keep contractors informed of smoothness of surface finish. Profilometer is equipped with two pens for operation on vertical curves.



DUST CONCENTRATION (above, left) in Pennsylvania Turnpike tunnels is ascertained by safety engineer with so-called midget impinger which is manually operated to draw in measured quantity of air and force it at high speed through fine nozzle in small tube containing 1 c.c. of alcohol. Any dust contained in air is intercepted in bottom of tube. Resulting solution is placed on glass slide, to be examined directly by microscope or magnified by projection on screen.



FRAMED TIMBER FALSEWORK utilizing 4-in. split-ring connectors throughout consists of two 54½-ft. trusses resting at each end on timber columns 26 ft. high. Designed by Frank P. Cartwright, timber structures specialist, to support concrete cross struts up to 8x13½ ft. in cross-section on piers completed by McLean Contracting Co., Baltimore, for Susquehanna River bridge at Havre de Grace, Md., falsework trusses carry more than 500,000-lb. load with maximum deflection of 1¼ in. at center of span. Double Warren type trusses, of select structural Douglas fir, have top chords of four 6x16-in. timbers and lower chords of four 6x12-in. pieces.





VIBRATORY PAN FEEDERS regulated by electric rheostat controls pass properly proportioned quantities of sized aggregates from bins of processing plant to cold elevator of asphalt mixing plant erected by Warren Bros. Roads Co., Boston, Mass., at Washington National Airport, across Potomac River from national capitol, to pave airfield runways and taxiways. Jeffrey units afford accurate control of aggregate feed.

BULLDOZER BLADE (below) on Adams motor grader clears right-of-way, levels freshly placed embankment and cuts side slopes and ditches on road job of F. A. Pasco & Sons, Viborg, S. D.







ONE OF FIRST USERS

Among others in various parts of the country, Kiker and Yount saw profit-making possibilities of the 2-Cycle Diesel—bought one of the first (shown below with 10-yd. Gar Wood 2-wheel scraper). Since have added the HD-10, 79 drawbar h. p. 2-Cycle Diesel (see letter and photo above).

ALLIS-CHALMERS

TRACTOR DIVISION—MILWAUKEE, U.S.A.

L. C. YOUNT

KIKER & YOUNT

BRIDGE AND HIGHWAY CONTRACTORS

REIDSVILLE, N. C.

O. C. GAITHER

June 7, 1940

E. F. Craven Company
Greensboro
North Carolina

Attention: Mr. E. Asbury Craven

Gentlemen:

We have been operating one of your new 108 h.p. Diesel Motor Tractors long enough so that we feel that we are in a position to give you a reasonable picture of our experience with it. This tractor, as of present date, has operated a few more than 2,000 hours since September 4, 1939.

We have been able to notice the saving in grease and time as a result of the 200 hour front idlers and truck rollers. The saving in time means of course means cheaper operating cost, and the saving in time means more hours on pay operations. We are amazed at the fact that in the equivalent of one year of operating, we have had to grease these parts only ten times.

The general operation of this machine has been satisfactory. It has come nearer operating all of the possible hours than any other piece of equipment which we have on our projects.

The motor, at present, seems to be operating as well as it did when we put it into service last fall. The oil consumption on it amounts only to the customary changes.

We find that with the electric starter, under all weather conditions, we are able to save from one half to three hours per day in getting started in the mornings.

Our operators have really taken to the new HD 10 and Grade Builder which you delivered to us last week. They have operated about all types of equipment competitive to this and say that this machine is by far the nicest all around piece to operate.

Very truly yours,

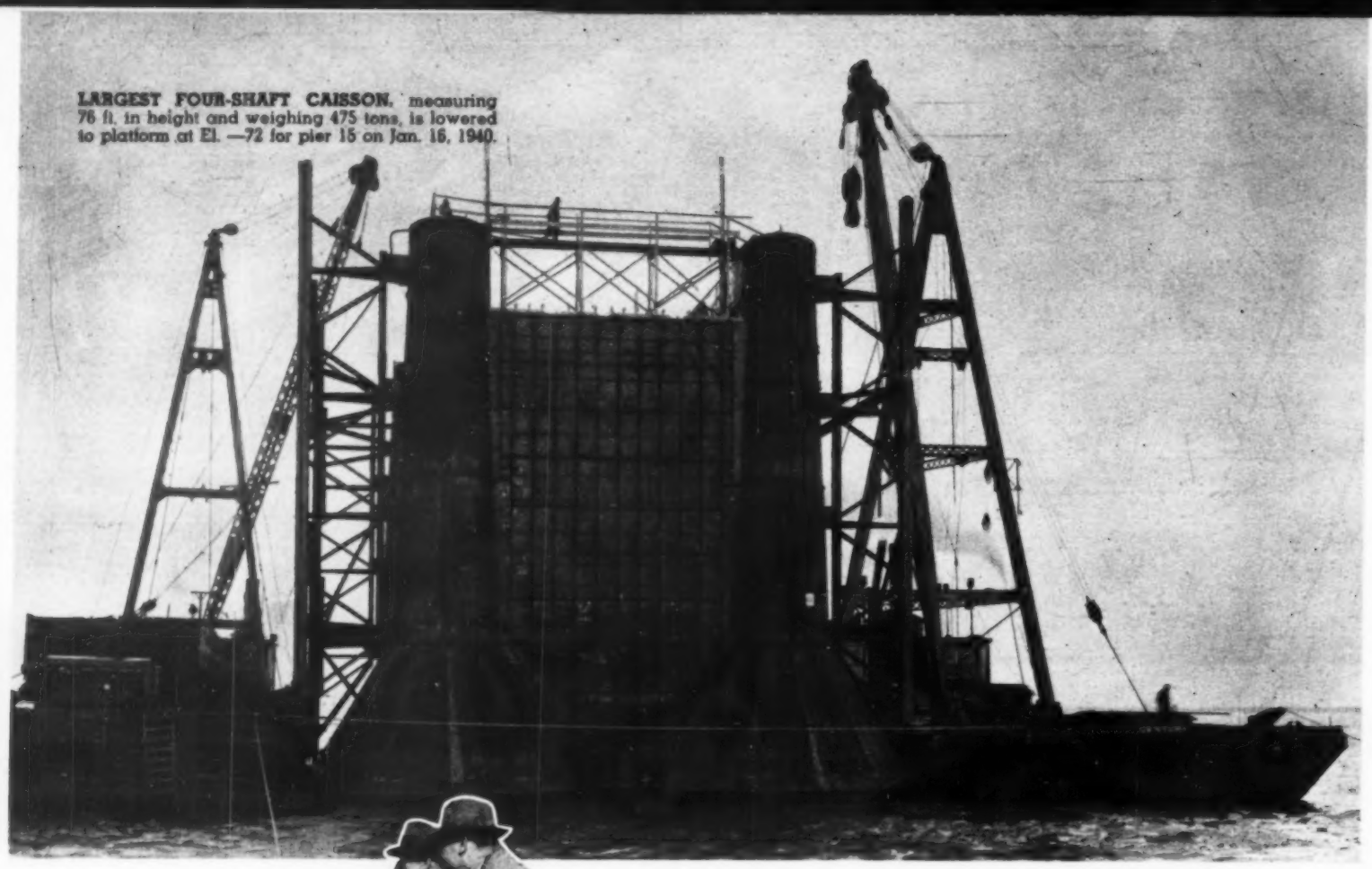
KIKER & YOUNT

By E. M. Knight

EMK:b

2-CYCLE DIESEL POWER

5 SIZES—HD-7, HD-10, HD-14 — 54 TO 108 DRAWBAR H. P.



LARGEST FOUR-SHAFT CAISSON, measuring 76 ft. in height and weighing 475 tons, is lowered to platform at El. —72 for pier 15 on Jan. 16, 1940.

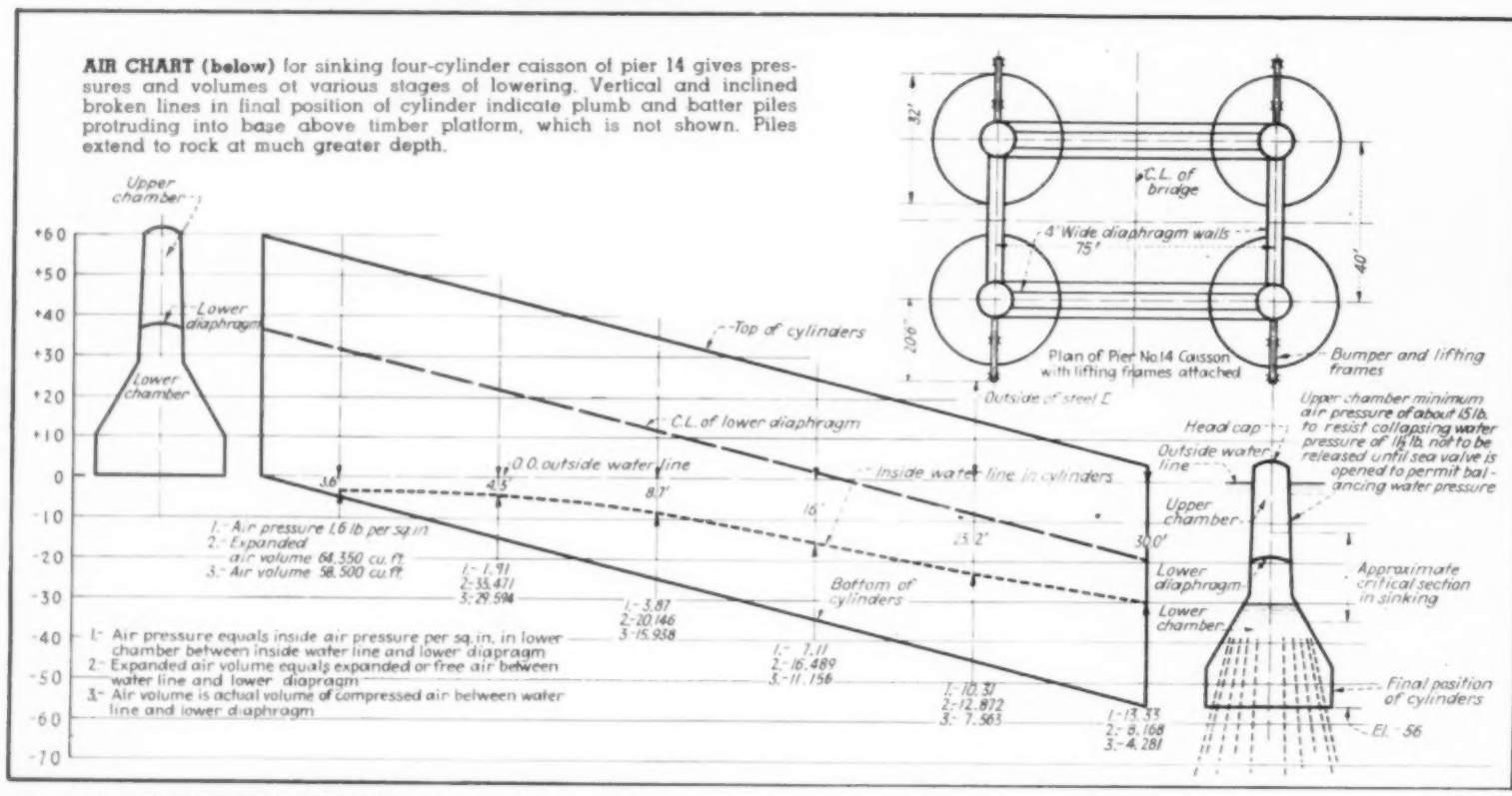


ON BRIDGE of pier 10 caisson **(right)** as it travels toward bridge location Construction Manager FRANK W. BARNES (in overcoat) and Superintendent WILLIAM DENNY take their post to direct maneuvers for Merritt-Chapman & Scott Corp., contractor.

Compressed Air Methods

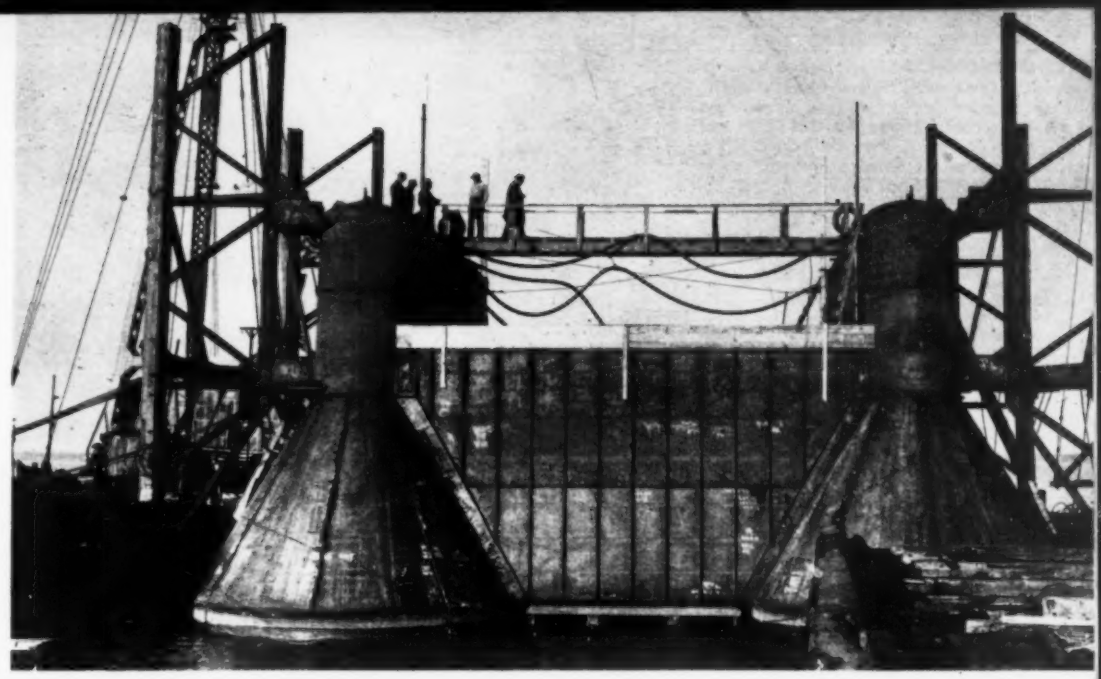
CONTROL SINKING OF FOUR-CYLINDER CAISSONS

AIR CHART (below) for sinking four-cylinder caisson of pier 14 gives pressures and volumes of various stages of lowering. Vertical and inclined broken lines in final position of cylinder indicate plumb and batter piles protruding into base above timber platform, which is not shown. Piles extend to rock at much greater depth.

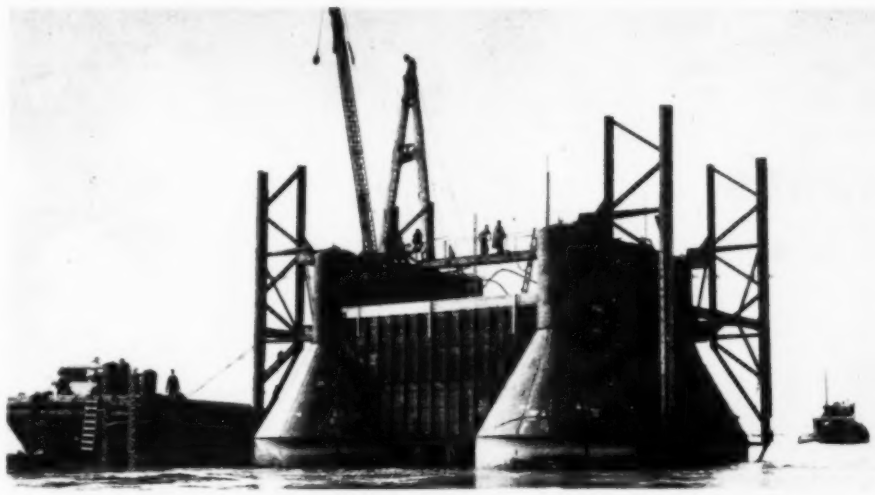


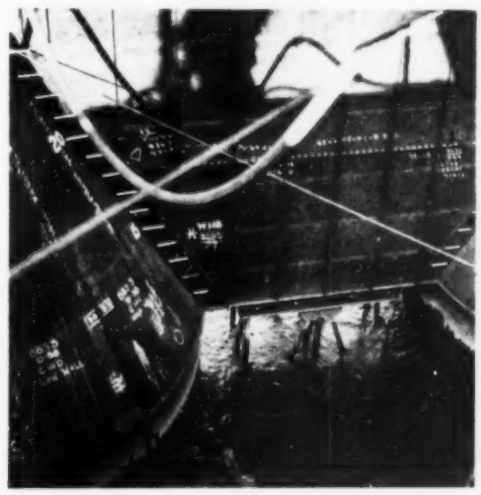
INGENIOUS ADAPTATION of diving bell principles to large multiple-cylinder caissons enabled the Merritt-Chapman & Scott Corp., New York, contractor for the $2,100,000 substructure of the Potomac River bridge at Ludlow Ferry, Md., 50 mi. below Washington, to float four-legged caissons of massive dimensions from a submerged fabricating platform 2 mi. upstream and to lower them accurately to position over clusters of steel foundation piles at depths up to 72 ft. below mean low water. Compressed air pumped into the lower chambers of air-tight corner cylinders floated the caissons off the assembly platform, and control of the air by manifold valves kept the great open-bottom tanks on an even keel during the towing and sinking operations. In the lowering

(Continued on page 79)

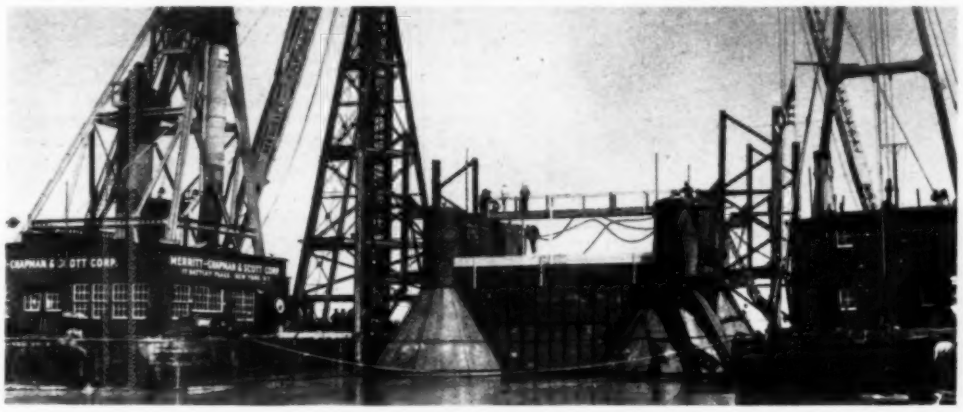


6 A.M. **FOUR-SHAFT CAISSON** 38½ ft. high, weighing 275 tons, for pier 10, is floated clear of submerged fabricating platform by pumping air into lower chambers of four corner cylinders from portable compressors on deck of derrick boat at left. Leaving is timed to catch ebb tide at 10 o'clock for sinking caisson at pier location, 2 mi. downstream.





7:30 A.M. **IN TOW BEHIND TWO TUGS,** caisson and attendant derrick boat proceed downriver toward bridge in background. Water ripples through steel framing **(right)** under diaphragm walls connecting corner cylinders. Continuity of reinforcing through water-tight cylinders is obtained during fabrication by inserting flat bars of cross-section equivalent to reinforcing through cylinder walls and welding tight.



10 A.M. **GUIDED AND STABILIZED** between two anchored derrick boats which control position of vertical truss frames, caisson starts down as air is released from lower chambers of corner cylinders. Manifold release valves are regulated to maintain level bearing.

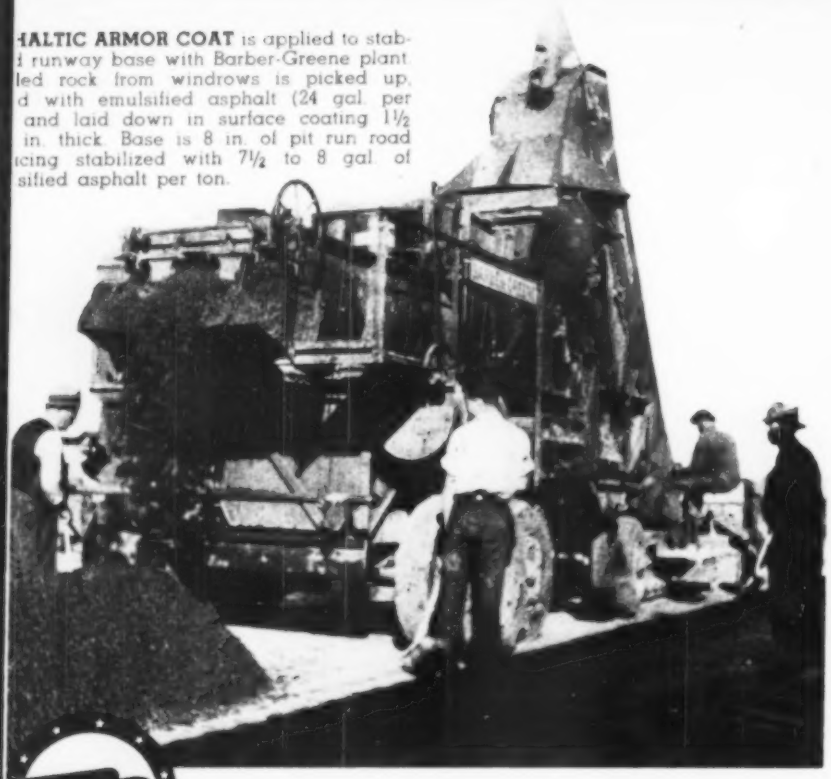


11:30 A.M. **AFTER FINAL ADJUSTMENT** of caisson to accurate position as checked by transits from range platforms, divers open sea cocks of upper chambers in corner cylinders, permitting 15-lb. compressed air in these chambers to escape. Head caps then are removed and lower diaphragms are cut out by diver using underwater gas torch.



LAMINATED TIMBER PLATFORMS (left) fitted with steel-lined rectangular holes for piledriving are fabricated in dock, towed to pier sites and loaded for sinking to position under water on timber piles cut off at grade.

HALTIC ARMOR COAT is applied to stab- l runway base with Barber-Greene plant. led rock from windrows is picked up, d with emulsified asphalt (24 gal. per and laid down in surface coating 1½ in. thick. Base is 8 in. of pit run road icing stabilized with 7½ to 8 gal. of sified asphalt per ton.



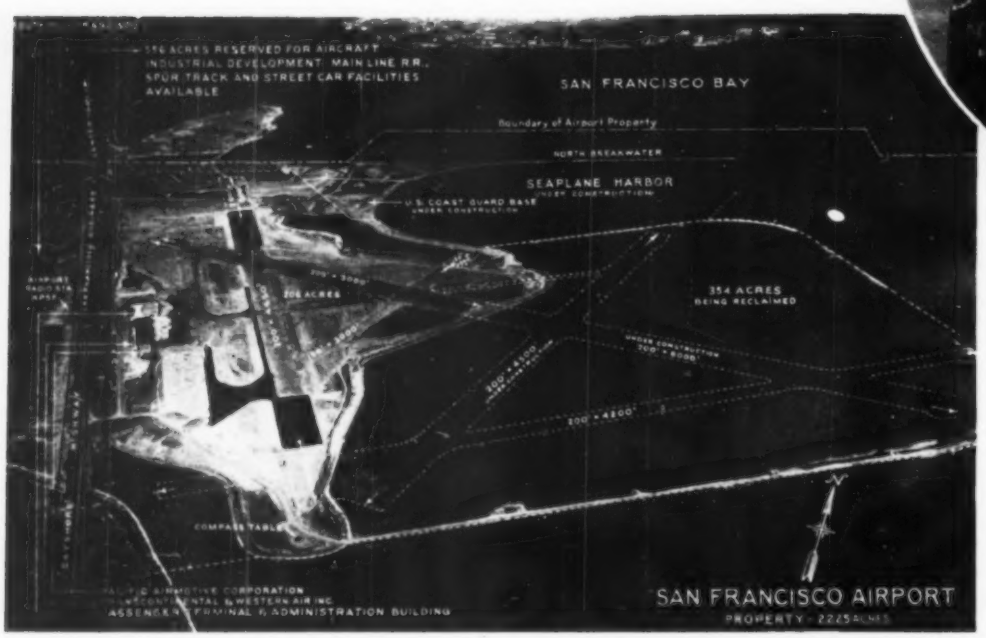
LIGHT EQUIPMENT, such as this dragline and truck, was required to take off some 30,000 cu.yd. of soft and wet tide-flat mud which was excavated to 3 ft. below grade and then backfilled with dry material.



FOR NATIONAL DEFENSE

Airport Expansion

USES ROAD-BUILDING METHODS AT SAN FRANCISCO



EXTENT OF WORK involved in expansion of San Francisco's municipal airport is indicated in this ground plan view, taken shortly after present program was started.



CITY OFFICIALS studied possibility of dredging and pumping this oyster-shell material to fill in areas inside levee before truck hauling program was proved to be more economical. (Left to right): M. B. ("PAT") SWEET, superintendent of airport maintenance; GEORGE D. BURR, assistant city engineer in charge of design, CAPT. B. M. ("MIKE") DOOLIN, airport superintendent.

CONTRACTORS are playing an important part in extending and improving San Francisco's municipal airport just south of the city, for which the city is expending $2,850,000. The work includes drainage, levee construction and filling as well as the paving and surfacing of runways, as indicated in the plan illustrated herewith. There is also the erection of structures and installation of lighting and radio equipment. The construction of runways for landings and takeoffs the contractor finds to be much like road building.

In the latter part of May, San Francisco advertised for bids on 1,000,000 sq.ft. of additional runway surfacing for this airport. This is only a small part of the runway work as a whole which, figured roughly, will include an area equal to 30 mi. of highway paved to 20-ft. width.



DUMPING MATERIAL (below) on extension of airport runway involved 1,300,000-cu.yd. contract for which Macco Construction Co. (Ben Wells, superintendent) built its own 3-mi. road from quarry to fill.



BACK IN CONSTRUCTION HARNESS to haul concrete and material trucks into Lake Washington bridge tunnels, Seattle, Wash., horse teams keep progress up to schedule for Bates & Rogers Construction Co., contractor, and L. J. Dowell, Inc., subcontractor (represented by Steve Dowell, on running board), after tunnel crews claim 1938 state law prohibits operation of gasoline engines in bores where men are working. Because Teamsters Union can supply no men who know how to drive horses, owners of teams handle reins.



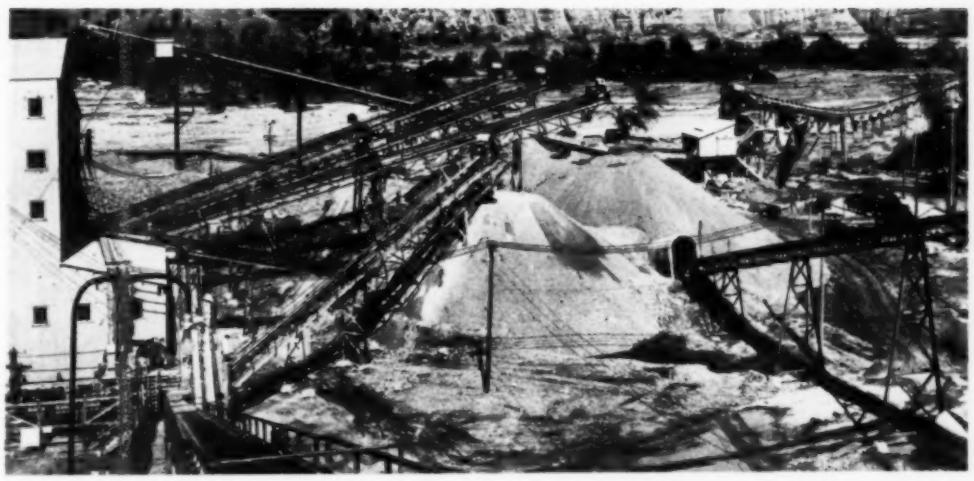
WOMAN WELDER. Miss Anna Lauer, of Germantown Welding Co., Germantown, Pa., makes dental repairs on shovel dipper, using G-E diesel-electric arc welding generator. Miss Lauer is Philadelphia's only woman welding operator.





FISH BY BUCKETFULL come up in dipper of Bay City ½-yd. shovel at Harbor Beach, Mich., on Lake Huron, when Otto Taylor, Saginaw, combines pleasure with business after school of carp enters bay where he has subcontract dredging small boat channel of new Coast Guard station for A. H. Proksch, Iron River, Mich.

Oddities



"THAR'S GOLD IN THEM THAR AGGREGATES" excavated from bed of Sacramento River at Redding, Calif., by Columbia Construction Co., Inc., Oakland Calif., under contract with U. S. Bureau of Reclamation to supply 10,400,000 tons of concrete aggregates for Shasta dam. Gold-recovery plant in mill building at left removes valuable metal from raw material before passing aggregates to stockpiles from which they eventually are transmitted in proportioned quantities to 9.6-mi. belt conveyor system crossing hills and valleys to Bureau's bins near dam site.



SHORT TRIPS ABROAD appear possible at Lynchville, Me., in Sebago-Long Lake region, where highway sign indicates actual distances to existing Maine towns.

Wood Panel Forms FOR BUILDING CONCRETE DAMS

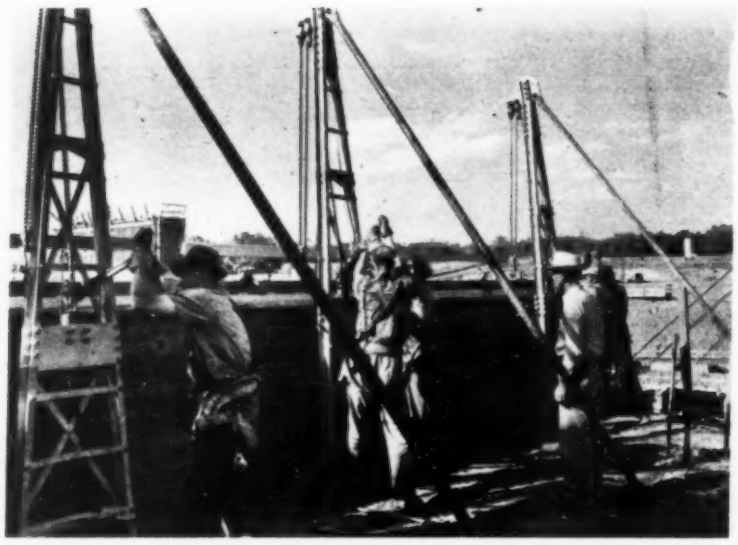
Part III

Third of a Series of Articles Dealing with Form Design, Manufacture, Handling and Cost-Keeping Methods

By H. P. MAXTON

General Cost Engineer,

Tennessee Valley Authority, Knoxville, Tenn.



LIGHT-WEIGHT A-FRAMES equipped with ratchet chain hoists and adjustable telescopic pipe backstays are selected again to raise single-course panels on TVA's seventh great flood control and navigation project at Watts Bar on Tennessee River.

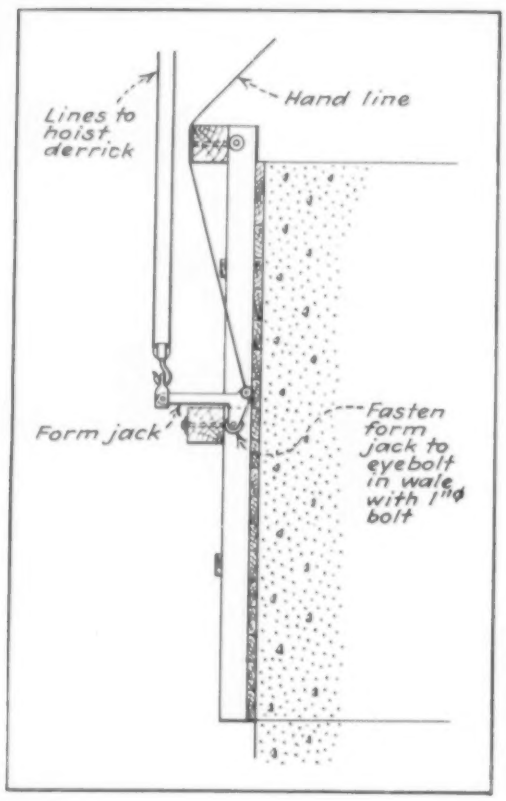


Fig. 1 . . . **COMBINATION FORM JACK AND LIFTING BAR (left)** at Norris Dam pries lower panel of two-course forms free from concrete and raises it clear of upper course.

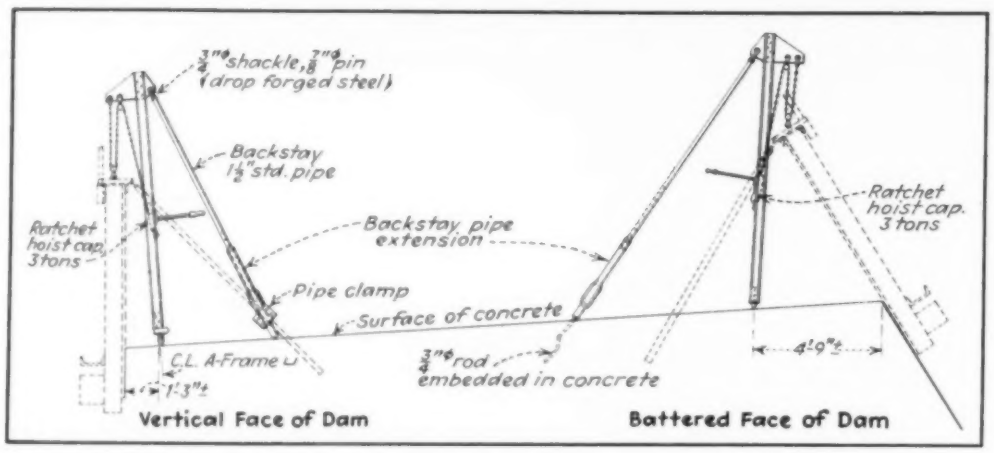
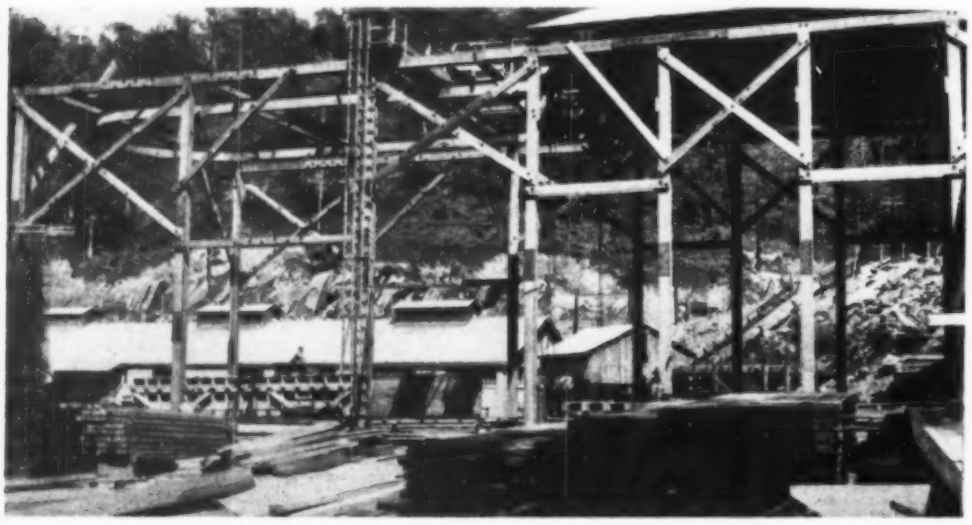


Fig. 2 . . . **SINGLE-COURSE PANELS (above)** 7 ft. high for 5-ft. concrete lift on Hiwassee Dam are raised on vertical and battered faces of structure by aluminum alloy A-frames equipped with ratchet roller chain hoists.



5-TON ELECTRIC TROLLEY HOISTS traveling on I-beam tracks handle heavy loads in form fabrication shop at Hiwassee Dam.

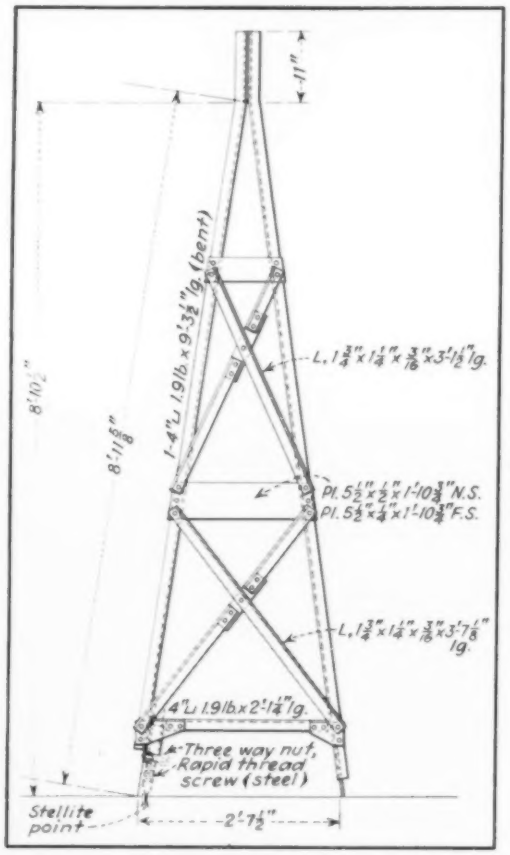
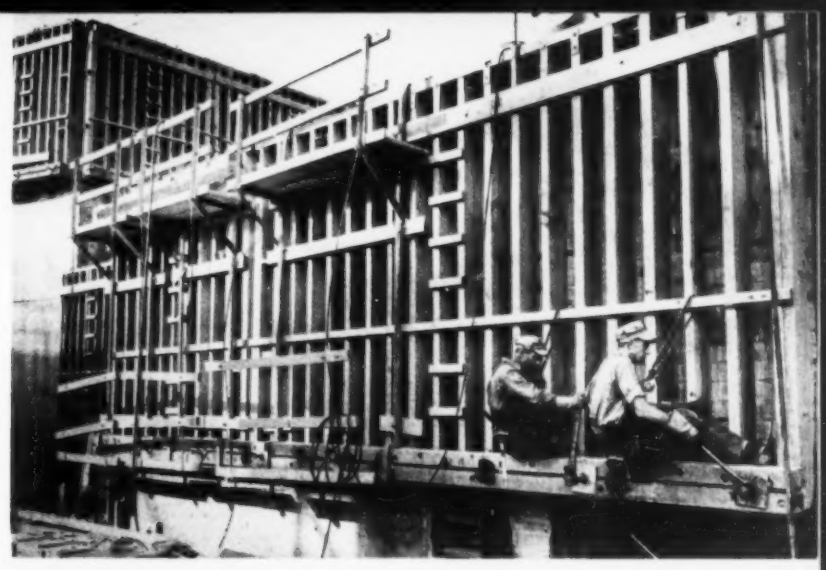


Fig. 3 . . . **ALUMINUM ALLOY A-FRAME** to handle forms on Hiwassee Dam weighs only 98 lb. Ratchet chain hoist adds 45 lb. to this weight. Screw foot on one leg adjusts A-frame to uneven concrete surfaces.



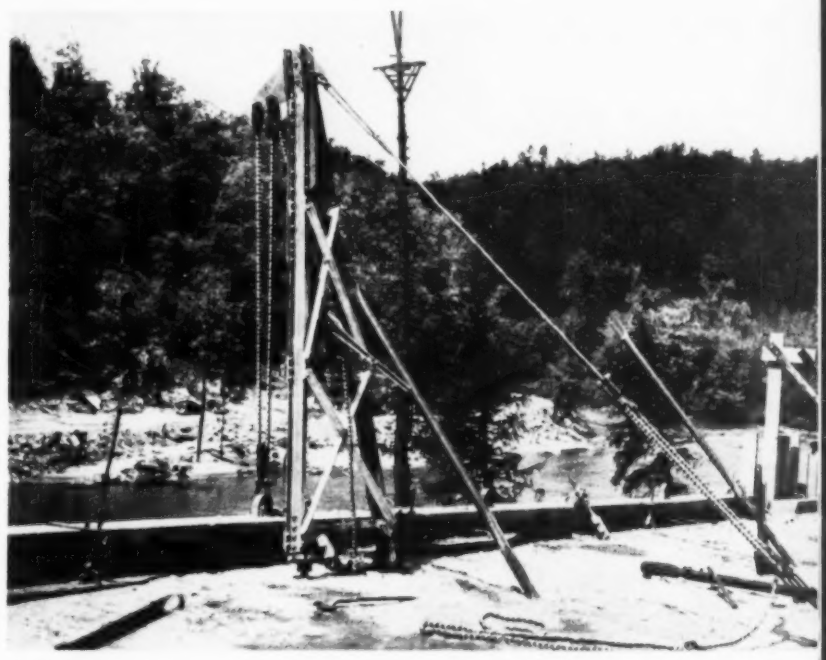


USING SAFETY BELTS. workmen remove anchor bolts from bottom wale of panel form for 10-ft. lift at Watts Bar navigation lock, at present under construction. Note detachable scaffolds on form panel.

FORM DESIGNERS face their real problem in striving to turn out forms that can be handled to position, set, aligned, braced and removed with the minimum amount of difficulty and wasted time, as this economy in handling results in the lowest possible field cost. A designer must remember that after a form is once built the constructors are forced, by the very design, either to follow established principles of construction or to alter the form, perhaps at prohibitive cost.

Form Handling Equipment—Initial field handling and setting of heavy panel forms usually must be done with movable power equipment. Field time studies prove the economy, wherever possible, of lifting and handling forms in units which are small and portable enough to be easily moved from block to block. For this purpose, Norris Dam, which used a system of double forms (that is, set a second course of panels upon the top ribbon of the form already filled with concrete) employed two Krane Kars. These mobile, solid rubber-tired units had a capacity of 5,000 lb. at 5-ft. radius, or 2,500 lb. at 10-ft. radius. Powered by gas and equipped

(Continued on page 90)

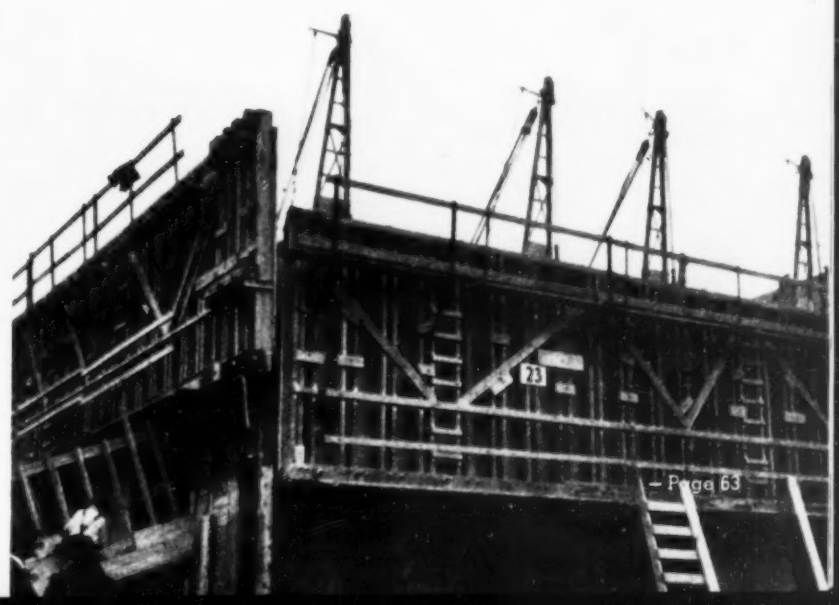


WEIGHING ONLY 143 lb., including ratchet chain hoist located at convenient height for operation by workmen, aluminum alloy A-frame at Hiwassee Dam has adjustable screw pin under left leg to permit leveling of frame on rough surfaces. In this case, steel cable guy and chain hoist are used in place of standard pipe backstay. Note tubular tie-braces for next lift of form accurately located in concrete by gooseneck templets, which are not visible here but which normally remain in position on top of form.



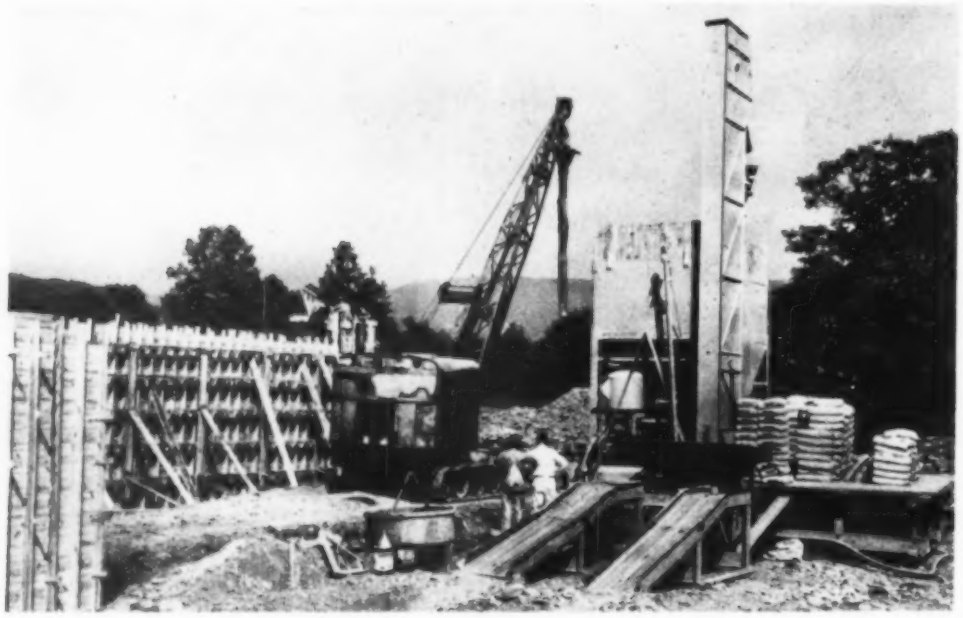
PAIR OF BATTER FACE FORM PANELS for Hiwassee Dam are loaded on to truck trailer by crawler crane. Note catwalks and pipe railings attached to forms at an angle which will put scaffolds in normal position when panels are set on batter face of dam.

SINGLE-COURSE PANELS (below) for 10-ft. lift of Chickamauga lock are raised by light-weight aluminum A-frame equipped with roller chain ratchet hoist. Forms are fabricated with scaffold and ladders to assure safety of workmen. At Chickamauga, ratchet hoists are located at tops of A-frames, and lever handles are operated by pull ropes. Fall guys replace standard pipe backstays in this instance.

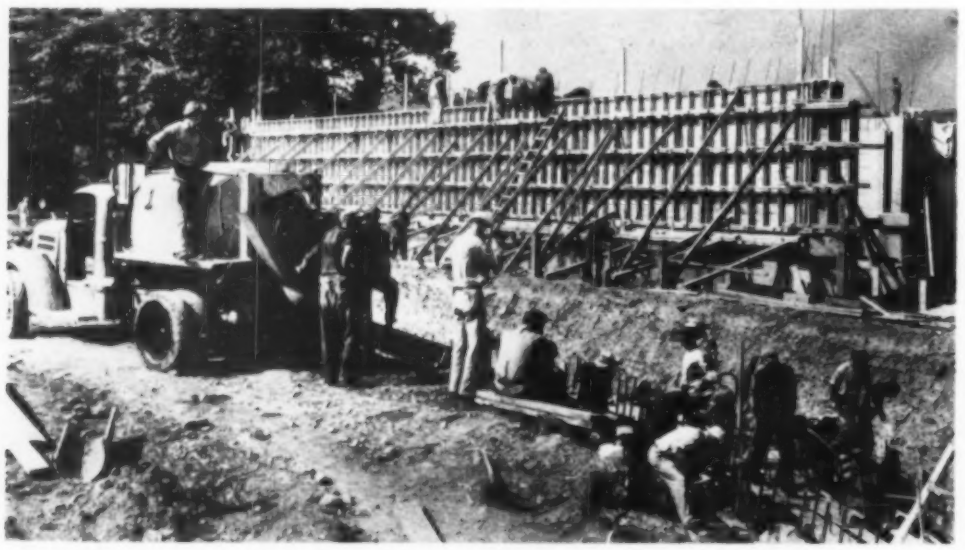




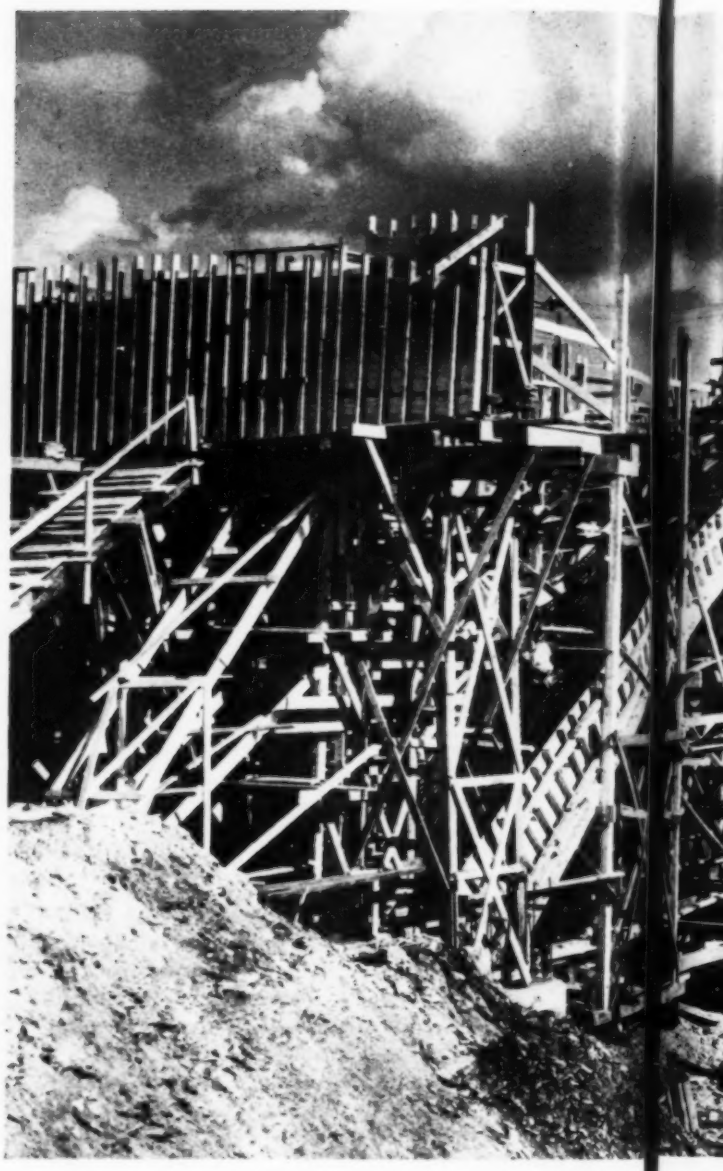
FOR RIGID-FRAME OVERHEAD on Frank Mashuda's grading contract, C. B. Taylor, Decorah, Iowa, handles concrete from truck mixer to forms in bucket on boom of crib-supported crane.



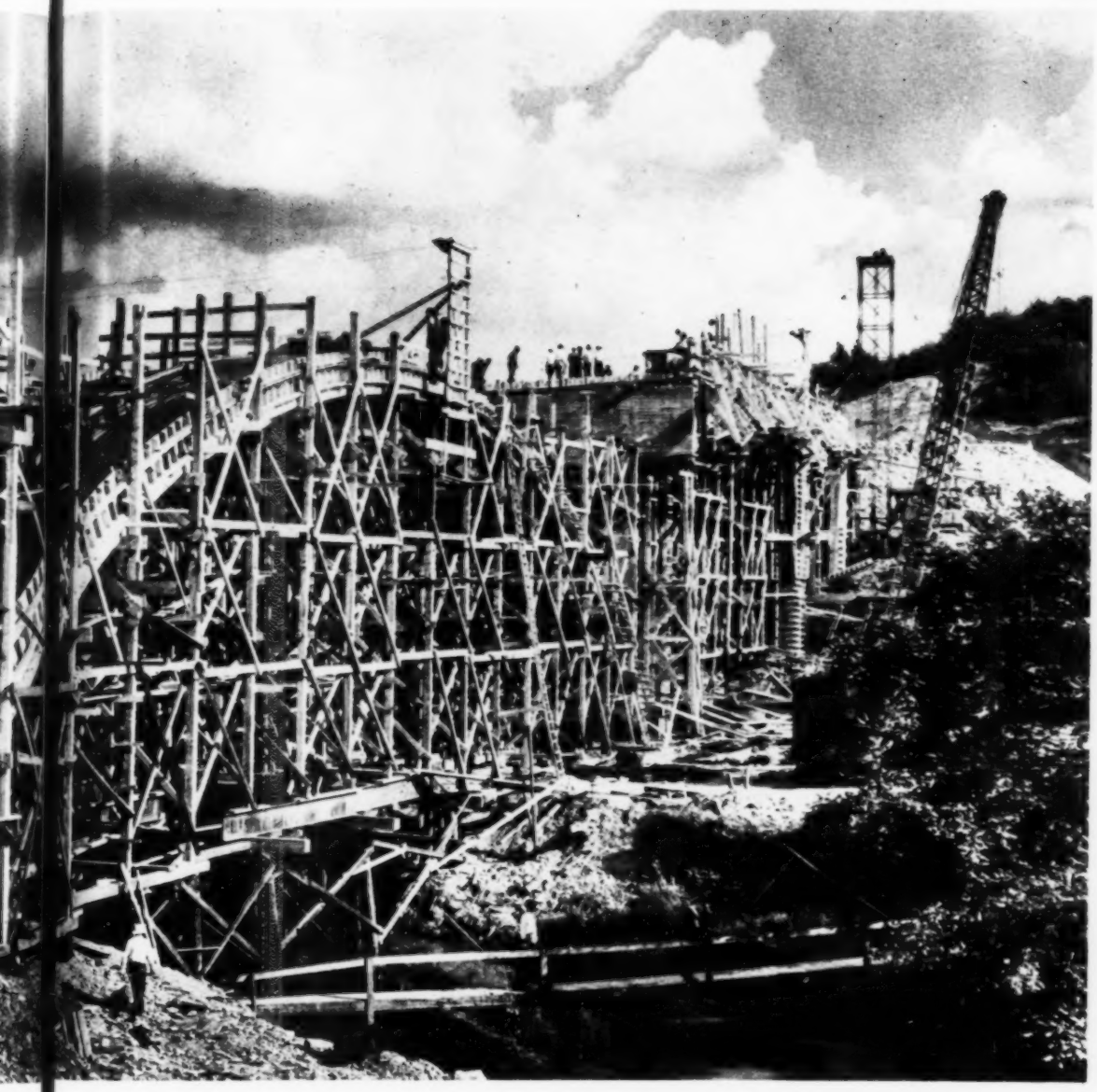
SUPPLYING CONCRETE to bridge subcontractors on section of Central Pennsylvania Quarry Stripping & Construction Co., O. C. Cluss, Uniontown, Pa., operates Bridge-Strayer portable batching and mixing plant of Erie Steel Construction Co. Unit, equipped with three-compartment bins, bucket elevator, worm feed for cement, weigh scales, water control and Jaeger ¾-yd. mixer, weighs 12 tons and is mounted on Chicago three-point-suspension trailer with dual pneumatic tires both front and rear (concealed here by truck ramp). After placing 30 cu.yd. for A. A. White in wall at left, plant will be hitched to truck to move to bridge abutment, where 75 cu.yd. is required. During night, unit will be hauled 1½ mi. to another bridge for 200-yd. pour on next day. Plant produces 25 cu.yd. per hour on 1¼-min. mix controlled by time device.



TRUCK MIXERS hauling from job batching plant on contract of C. J. Langenfelder & Son deliver concrete to footings, piers and T-beam spans of bridge over Conococheague Creek in Path Valley. Flexible-shaft vibrators driven by small gasoline engines vibrate concrete internally.



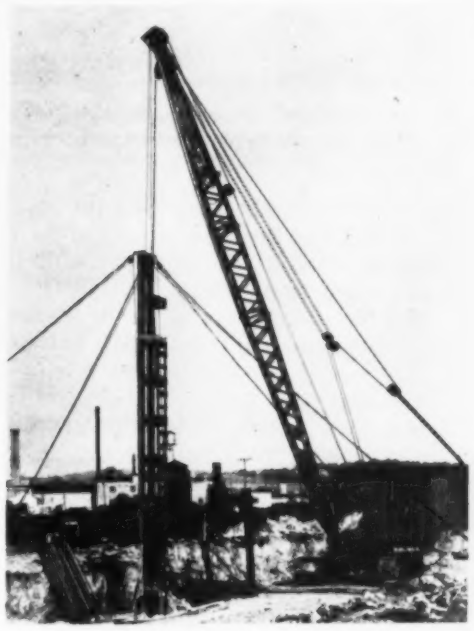
307 BRIDGES FOR *Pennsylvania Turnpike* COMPRISE FOUR MAJOR TYPES



SPLIT RING CONNECTORS are used in fabricating trusses of falsework designed by William W. Carlton, Cincinnati, consultant on falsework and forms for Ferguson & Edmondson Co., Pittsburgh, contractor on New Stanton viaduct, Turnpike's largest structure, which incorporates 170-ft. clear central span of three-rib open spandrel arch design. Tower bucket in right background delivers concrete to hopper at deck level for distribution by carts. At left may be seen steel reinforcement in forms of one arch rib.



SKID DRIVER picks up mandrel used in driving corrugated metal shells for cast-in-place concrete piles to support bridge crossing state route 31 on H. R. Dickens' contract.



FLUTED, CLOSED-END STEEL SHELLS (below) for cast-in-place concrete piles are driven by steam hammer **(above)** in guyed leads for foundation of stream crossing at Somerset interchange on Connell & Laub contract. This type of steel pile shells is used under about a dozen bridges.



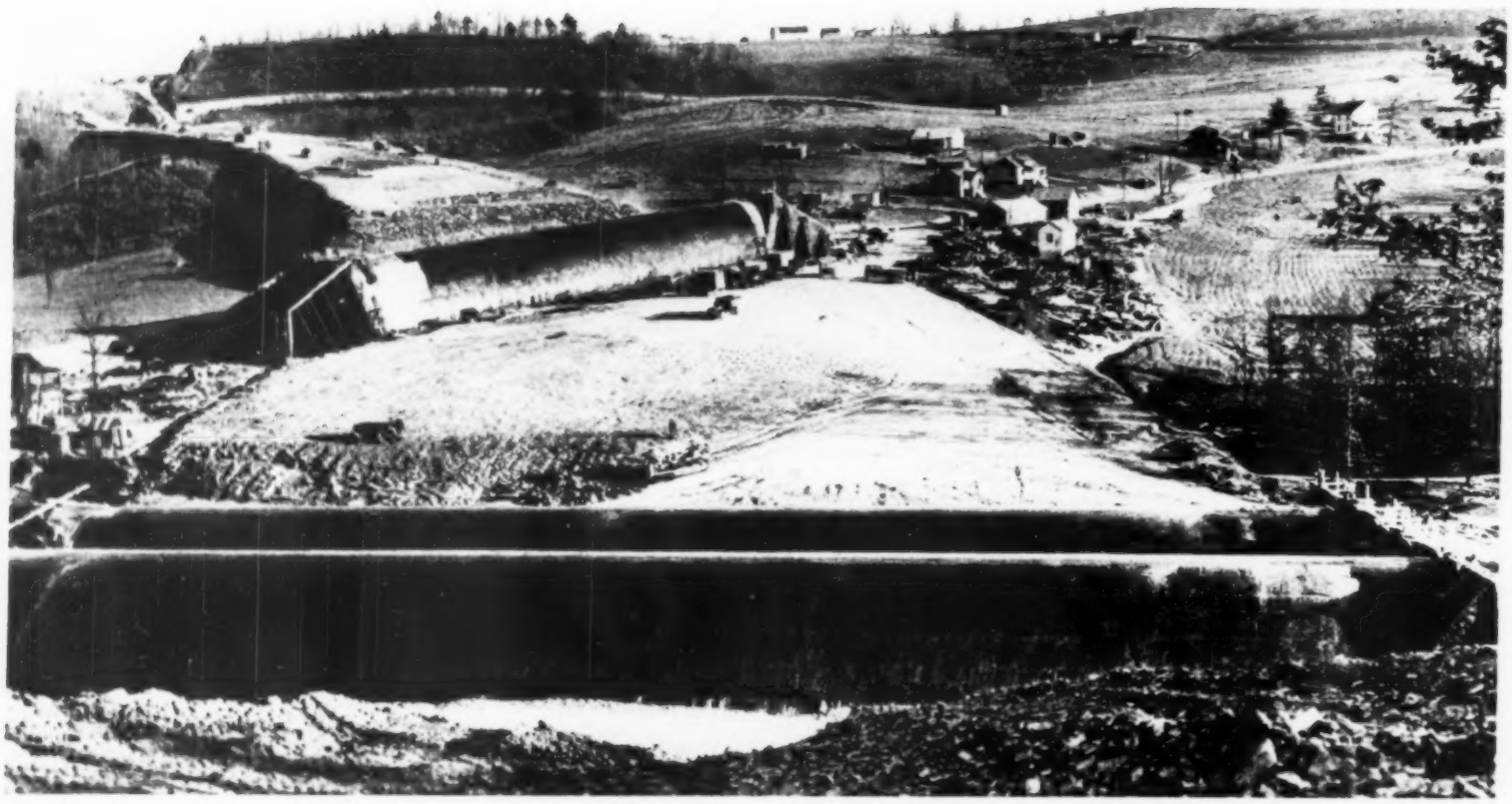
DRAINAGE AND GRADE SEPARATION on the 160-mi. Pennsylvania Turnpike represented one of the largest bridge programs ever undertaken in connection with a single project. Of the total of 307 bridge structures on the $70,000,000 PWA-RFC financed Turnpike, 144 are for drainage and the remainder for grade separation.

Drainage Structures — Turnpike drainage structures average about one per mile of roadway. Despite its 160 mi. of length, the location of the superhighway is unusual from a drainage standpoint in that no stream of great magnitude is encountered, and only three or four are of any considerable size. Therefore, a large number of small structures had to be built.

Types of drainage structures include arches under fill, reinforced-concrete slabs, reinforced-concrete T-beams, steel I-beams of both simple-span and continuous types, and a few reinforced-concrete box culverts. Arches comprise about 60 per cent of all drainage structures, varying in size from a 6 ft.-span arch culvert about 90-ft. long to a twin span structure over Clear Creek, Bedford County, which consists of two 52-ft. spans, 305 ft. long, and contains more than 8,000 cu.yd. of concrete. In all, there are 26 arches with spans in excess of 18 ft., and seven of them are of the twin span type.

Many of the arches are unusual by reason of the great heights and weights of fills over them. The large twin arch over Clear Creek has 90 ft. of fill over the crown; many other arches have fills of from 30 to 90 ft. over their crowns. There are nineteen drainage structures of reinforced-concrete T-beam type, of which eight are multiple spans, the largest having three spans of 45 ft. The largest I-beam structure used for drainage, over Conodoguinet Creek, is a continuous I-beam bridge having three spans of 69 ft. each.

Although most of the drainage struc-



DOUBLE ARCHES of 52-ft. span, designed to carry highway fill rising more than 90 ft. above crown across Clear Creek, exceed 300 ft. in length. N. R. Corbiselio, contractor, places more than 8,000 cu.yd. of concrete in twin drainage spans and more than 4,000 cu.yd. in arch of adjacent highway crossing by well-organized progressive construction schedule, involving all three arches, which permits successive pours on 21 consecutive working days.

tures are of small span, even the smallest represents the expenditure of a considerable sum of money because of the great roadway width.

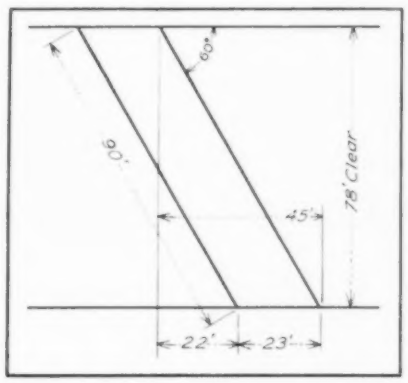
Grade Separations — Grade separations presented problems of great proportions, as no intersecting roads cross the Turnpike at grade for its entire distance. About 180 state and township roads crossed the Turnpike line. It was possible to relocate or vacate some of these cross roads, reducing the number of intersections to 148. Three are provided for under viaducts, but the remaining 145 required special structures. In addition, there are four railroad and one trolley crossing. A small number of private crossings are included in the grade separations. Of the grade separation structures, 88 are overhead and 60 under Turnpike grade. Those under grade are provided for generally by single-span reinforced-concrete T-beam

(Continued on page 106)



LOAD TEST on narrow, skewed rigid-frame reinforced-concrete bridge at Hustontown removes all doubts regarding safety of this type of design. First test, consisting of placing string of three 13-ton trucks in each lane, with 3 to 6 ft. between rear ends and front bumpers of vehicles, is followed by load test using Marion 361 power shovel weighing 40 tons, with planks under crawlers. It proves impossible to measure any deflection with engineers' transit; rotation in structure can be noted only by increased ease of slipping a knife blade into expansion joint between frame and wing wall.





FOR SINGLE-SPAN OVERHEAD BRIDGES crossing Turnpike at angle of intersection of 60 deg. or greater **(right)**, designers utilize reinforced-concrete rigid-frames similar to this structure at Hustontown on section of C. J. Langenfelder & Son. Load test Aug. 14, 1939, when concrete is 30 days old, proves safety of design for narrow bridges skewed 30 deg. from right angle.

Rock Spreader

FACES EARTH DAM SLOPE



POWER-DRIVEN TOOTHED ROLLER at end of tilted trailer body effects uniform rate of rock discharge on dam slope. Tail-gate is raised and lowered by electric motor.

FOR APPLYING A 30-IN. LAYER OF RIPRAP paving to the 1 on 3 upstream earth slope of Hansen dam, U. S. Engineer Department flood control project in California involving placement by the Guy F. Atkinson Co., contractor, of 14,700,000 cu.yd. of fill in an embankment 120 ft. high and 9,500 ft. long, a trailer with tilting body for end discharge is employed. Loaded with 30 tons of rock, the trailer is lowered by cable from an electric dragline down the face of the dam and starts to discharge as it is pulled back up the slope. Uniform dumping of rock is controlled by a power-driven toothed roller at the rear end of the tilted trailer body; this roller rotates just above bed level. The tail-gate opening is regulated by a small electric motor.

Loading of the trailer is done by gravity from trucks operating on a timber ramp elevated at one end to permit dumping of rock directly into the body of the spreader. The motors operating the toothed roller for discharging the rock and for raising and lowering the tail-gate are supplied with electric current through a 400-ft. cable. This electric cable is wound on a spring-operated reel on the front end of the spreader which automatically takes up the slack as the trailer is pulled up the sloping embankment.



CABLE FROM ELECTRIC DRAGLINE lowers and raises rock-spreading trailer on 1 on 3 earth slope of upstream face of dam.

SMALL TOOLS ON CONSTRUCTION



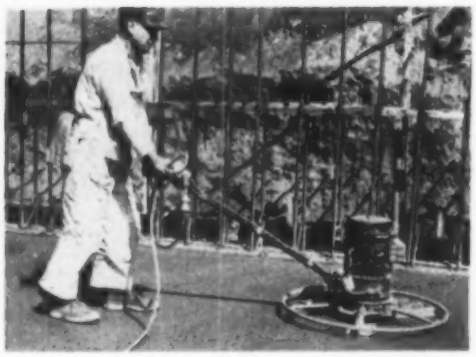
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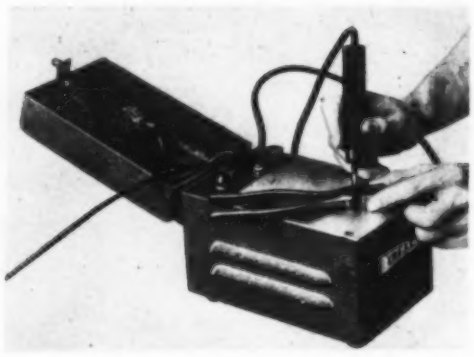
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3



4



5



6

1 **CLOSE-QUARTER DRILL** (Ingersoll-Rand) is fed with aid of adjustable wrench (Crescent) atop 470-ft. high main cableway tower at Shasta dam, in California, during installation of pillar crane by workmen of Pacific Constructors, Inc.

2 **DRIVING OF STEEL PINS** for holding forms in place during paving of concrete lanes of Pennsylvania Turnpike is done quickly with compressed air hammer.

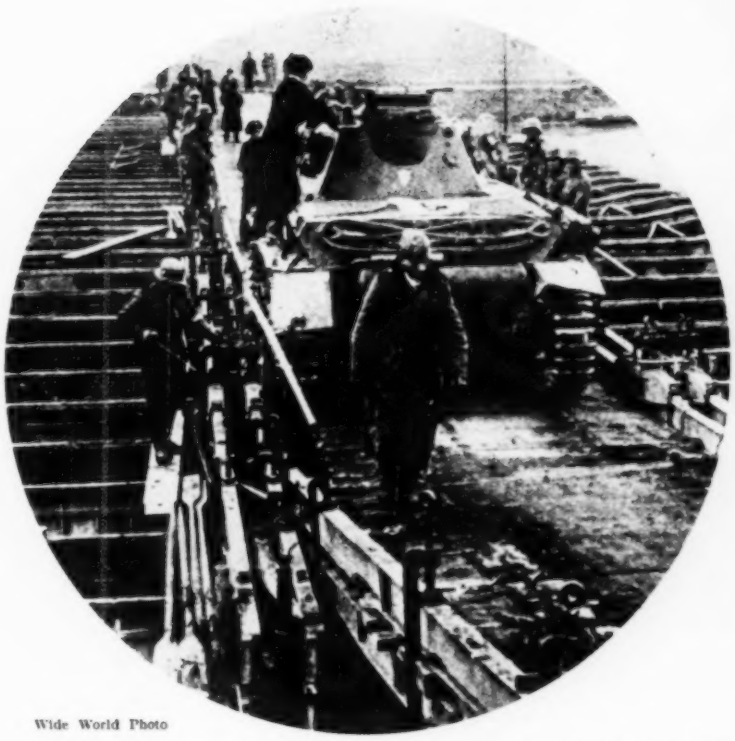
3 **TO STRAIGHTEN BENT STEEL COLUMN** of industrial building workman employs portable hydraulic jack (Blackhawk Mfg. Co.) with chain pull plate hook-up. Ram is anchored against sturdy beam resting against wood blocks. Pressure is applied through flexible hose by pumping handle of tool.

4 **FOR FINISHING CONCRETE FLOOR SURFACES** at water treatment plant of Metropolitan Water District of Southern California this mechanical float (Kelley) is used. It consists of three crucible steel trowels mounted on shaft that is rotated at 100 r.p.m. by 2½-hp. electric motor. Weight is 300 lb. Machine exerts higher pressure that can be applied by hand, thus enabling drier concrete mix to be used.

5 **FOR MARKING TOOLS** to prevent loss or theft and insure proper identification, here is an electric etcher (Ideal Commutator Dresser Co.) with all parts inclosed in portable case. Etching heats can be varied from 120 to 700 watts, a red indicator lamp burning brighter as hotter temperatures are turned on. Using hot point of tool as in writing with a pencil, marking is clearly and permanently burned into metal of tool. Standard unit is 110-v., 60-cycle a.c. current.

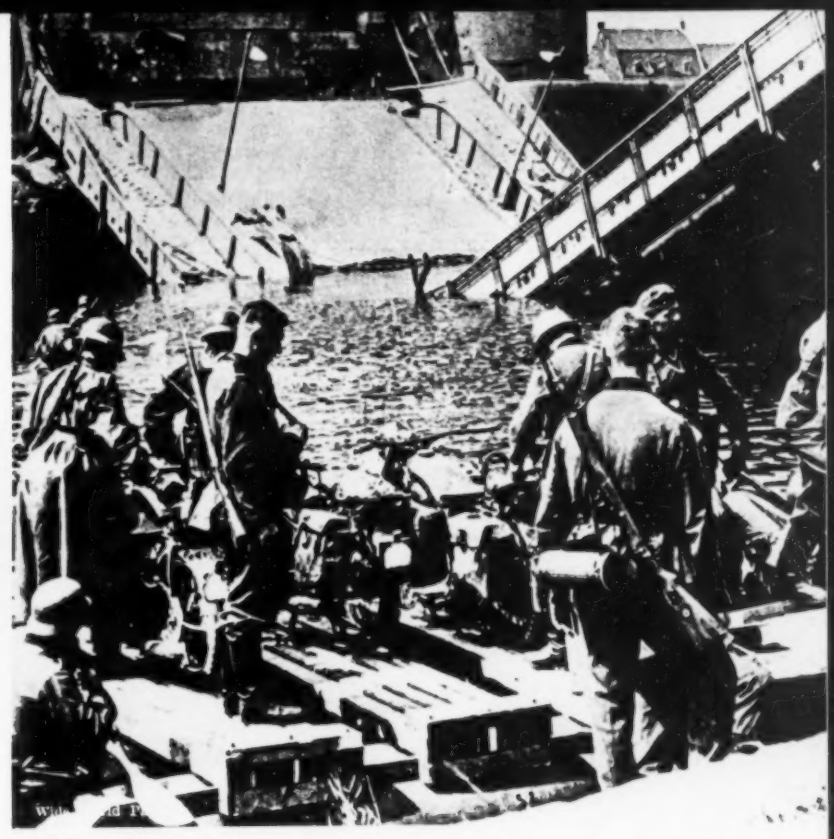
6 **FOR RAISING SCAFFOLD** and supporting platform at desired elevation this "Jiffy" jack (Hormel) on vertical wood post is operated by foot of worker during house construction by Essex Home Improvement Co., of Newark, N. J.

Photo, B. A. Wurgal



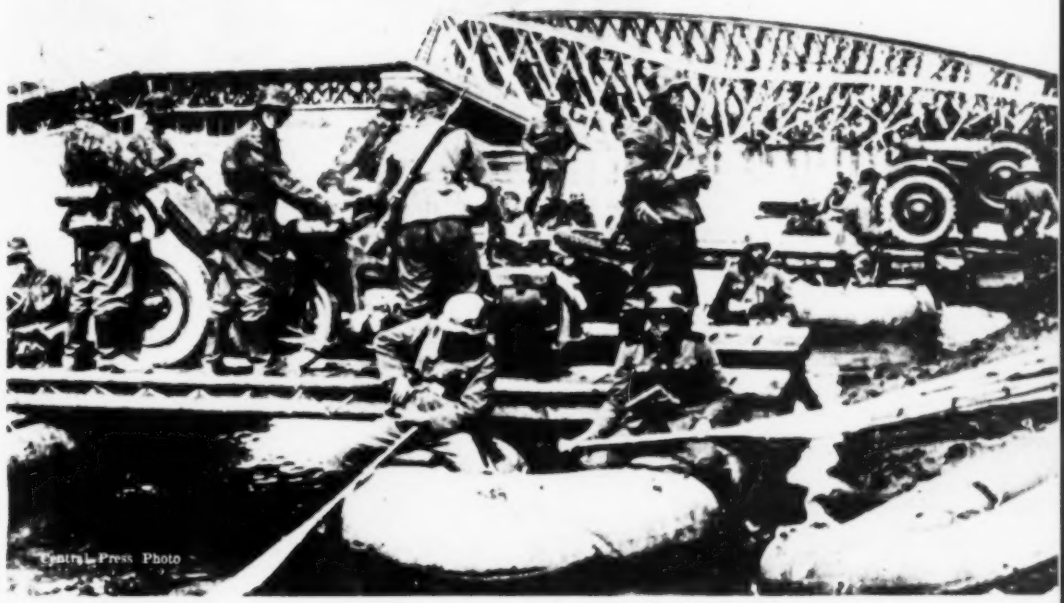
Wide World Photo

FRANCE—German tank crosses Meuse River between Sedan and Glaine on pontoon bridge built by Nazi engineer troops. Passed by French censor.



THE NETHERLANDS—German engineer troops prepare to construct pontoon bridge across river where existing bridge, in background, was destroyed by the Dutch to halt march of the invader. Passed by German censor.

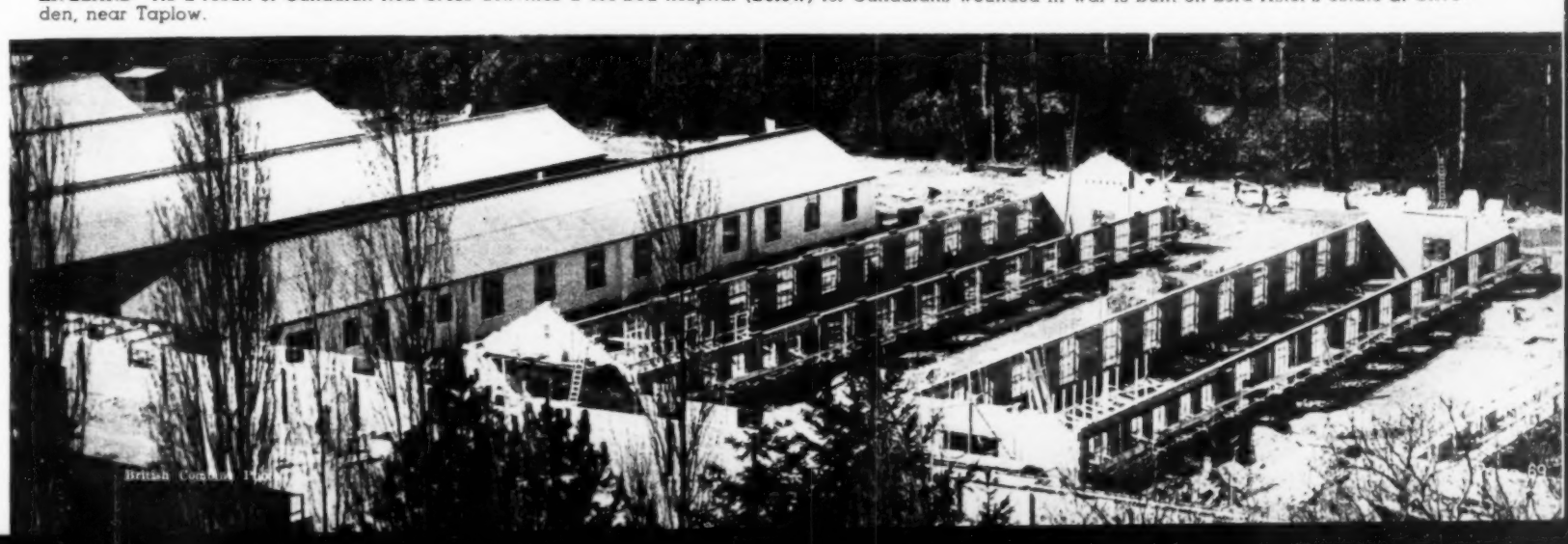
In the Wake of the War



Central Press Photo

BELGIUM—German troops start construction of temporary river crossing during their invasion of Belgium. In background is wreckage of original bridge dynamited by Belgians to halt German advance.

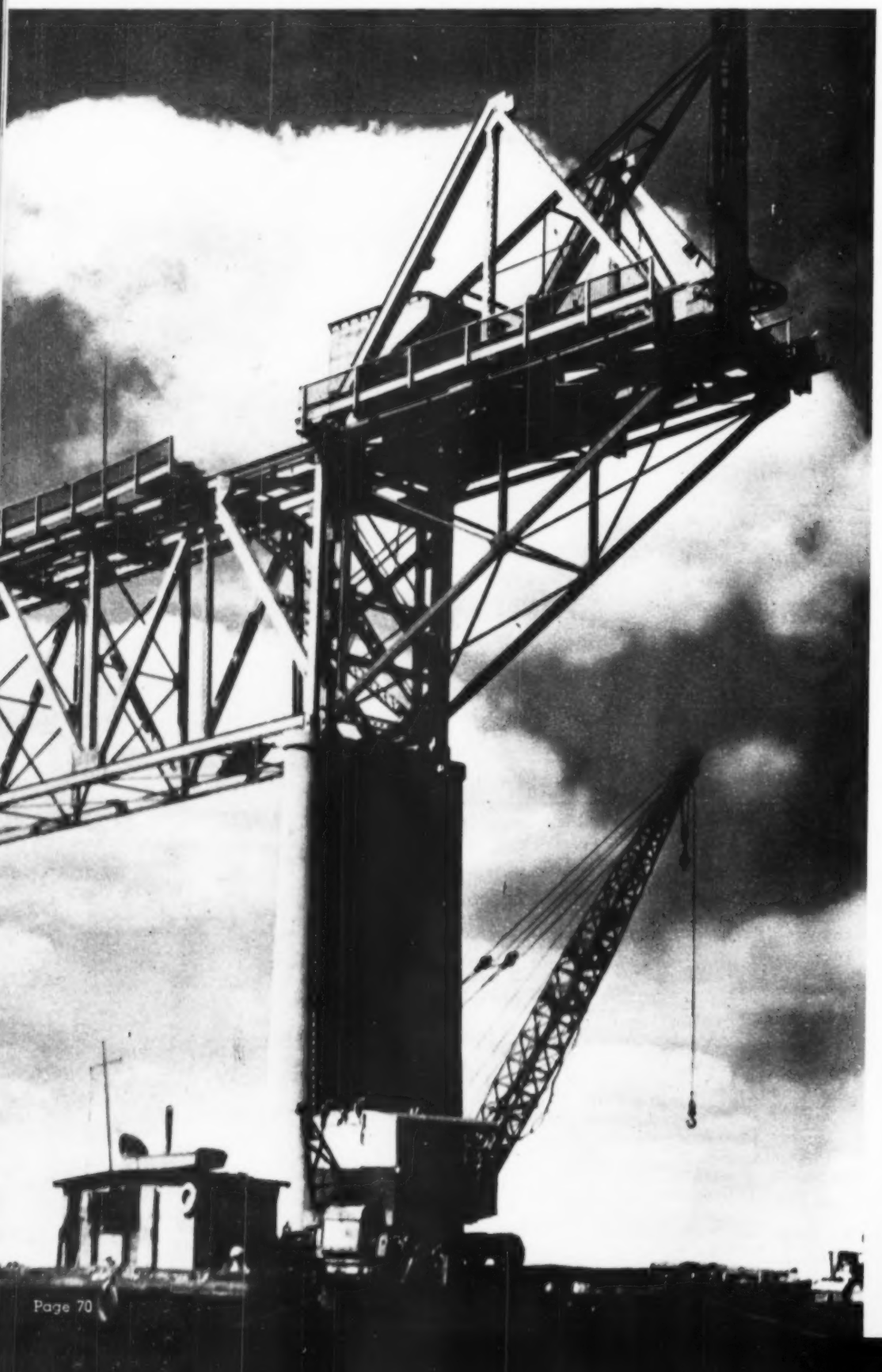
ENGLAND—As a result of Canadian Red Cross activities a 600-bed hospital **(below)** for Canadians wounded in war is built on Lord Astor's estate at Cliveden, near Taplow.





MAIN CANTILEVER of ¼-mi.-long Jamestown bridge over Narragansett Bay, R. I., has span of 640 ft. Structure cost approximately $3,000,000.

ON TALL CONCRETE PIER (below) built in deep water within sheetpile cofferdam, erection of anchor arm for cantilever is started by stiff-leg derrick traveler receiving steel delivered by barge.



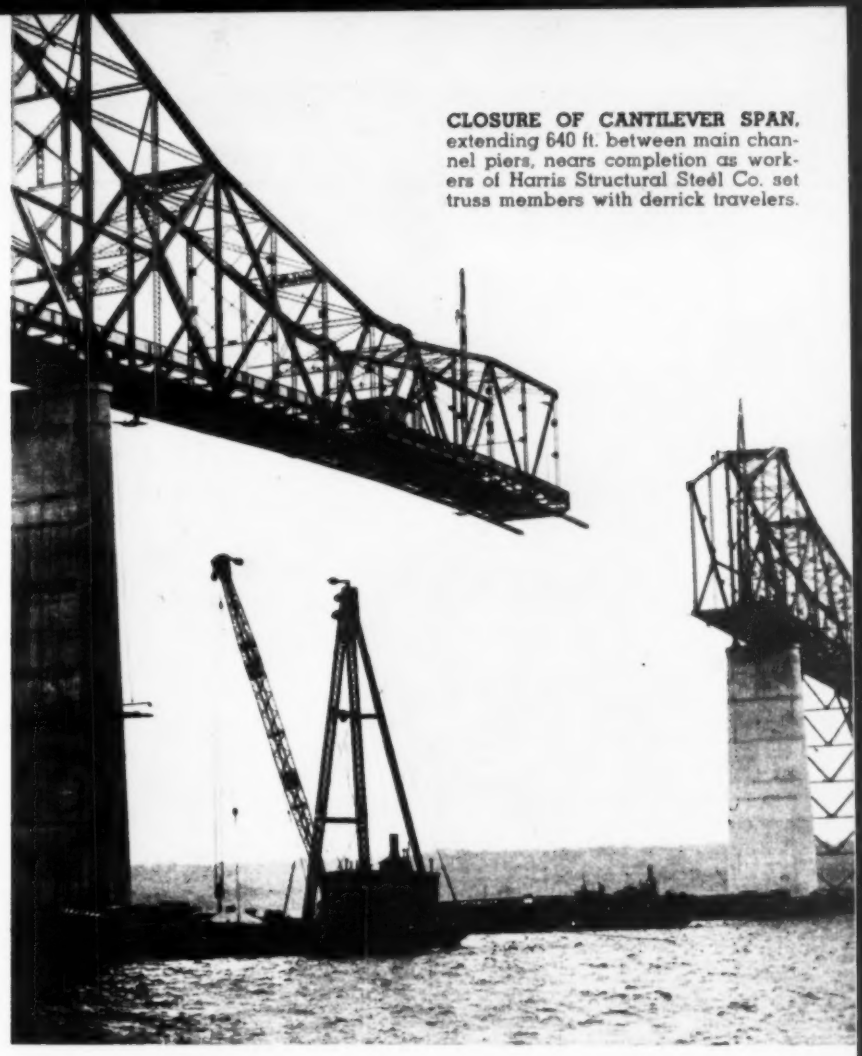
JAMESTOWN BRIDGE HAS 640-Ft. Cantilever Span

Photos, Herb Foster





STEEL ERECTORS, working 120 ft. above waters of Narragansett Bay, place last chord members in deck truss flanking main cantilever span.



CLOSURE OF CANTILEVER SPAN, extending 640 ft. between main channel piers, nears completion as workers of Harris Structural Steel Co. set truss members with derrick travelers.

STEEL WORKERS above the west passage of Narragansett Bay riveted into place in June the last steel member in the 640-ft. main cantilever span of the 1¼-mi. long Jamestown bridge, linking Conanicut Island with the Rhode Island mainland. The new $3,000,000 structure provides a long-needed link in the coastal route between New York and New England shore points that will save some 50 mi. of circuitous and congested travel between New York, Cape Cod, Buzzard's Bay, and other New England shore points. A municipal project, the bridge was begun in March, 1939, financed by a PWA grant of $1,404,000 and a bond issue of $1,700,000 sold by the Jamestown Bridge Commission which was created by the Rhode Island legislature to build, operate and maintain the crossing.

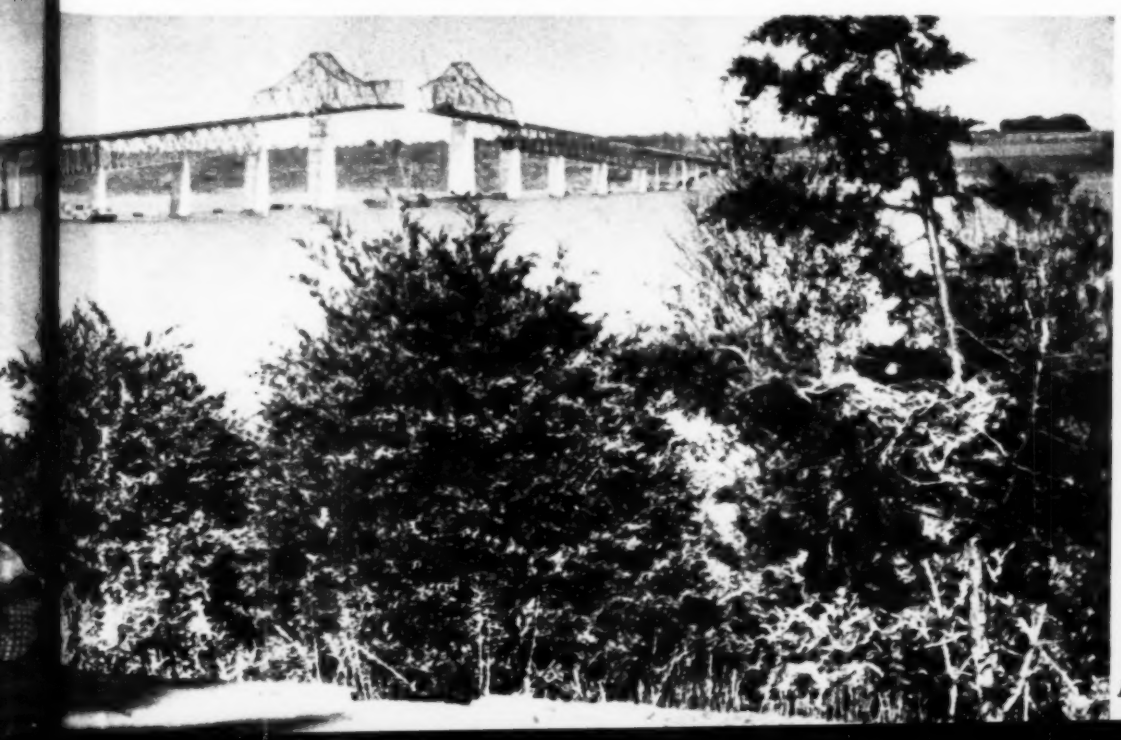
Crossing the bay near Saunderstown, the bridge has a total length of 6,600 ft. The main cantilever span of 640 ft., with a clearance of 135 ft. above mean high water, is flanked on each side by an anchor arm 256 ft. long and three 270-ft. deck-truss spans. On the eastern end 750 ft. of steel girder trestle connects the third deck-truss span with the abutment on Conanicut Island. On the western end steel girder spans, totaling 1,500 ft., extend from the third deck-truss span to a point about 2,000 ft. from the shore, from which point steel stringers on concrete pile bents carry the roadway to the shore. The bridge carries a reinforced-concrete roadway 22 ft. wide between curbs, with a 3-ft. concrete sidewalk on one side. The roadway on the main cantilever span will be of the open steel grid type.

In building the bridge substructure involving 32 concrete piers, some founded directly on rock and other on piles, Merritt-Chapman & Scott Corp., used 17 floating rigs, including a floating concrete plant equipped with two mixers, with a capacity of 50-60 cu.yd. per hour. The hardest part of the substructure job was encountered in building, in deep water, the main piers supporting the cantilever span. First, cofferdams of interlocking steel sheeting were driven 10 or 15 ft. into the bed of the bay around a wooden guide frame. In the case of the larger cofferdams these frames then were lifted out and supplanted by huge frames of structural steel (the largest weighed 156 tons) which were picked up bodily by a crane operating from the lighter *Monarch* and set in place to brace the sheetpiling. The bottom then was dredged out by clamshell buckets, steel bearing piles were driven to bedrock and, without unwatering, a concrete seal was poured by the tremie method.

When the seal had set, the cofferdam was unwatered. The steel piles were cut off at the top of the seal and the reinforced distribution slab laid in the dry. In the large cofferdams that had re-

(Continued on page 108)

NEW OVER-WATER ROUTE (below) linking Conanicut Island with Rhode Island mainland affords 50-mi. short cut for traffic between New England shore points.



Present and Accounted For

A PAGE OF PERSONALITIES



BARTLETT AWARD for outstanding contribution to highway progress during 1939 is presented to Robert Moses **(right)**, Commissioner, Dept. of Parks, New York City, by State Highway Commissioner Murray D. Van Wagoner, of Michigan, retiring president of American Road Builders' Association.

Highway Information Service Photo



BELT PARKWAY, 31-mi. divided lane concrete-paved superhighway circling Boroughs of Queens and Brooklyn, N. Y. City, is opened to traffic June 29 as map of route is studied by (left to right): COL. H. W. HUDSON, construction engineer for Madigan-Hyland, consulting engineers; JOHN C. RIEDEL, chief engineer, Board of Estimate; and GEORGE E. SPARGO, executive officer for commissioner Robert Moses of Department of Parks of New York City.



TRIBUTE TO TUNNEL BUILDER takes form of testimonial dinner with attendance of 450 at Hotel Commodore, New York City, for R. FRANK LEE, general superintendent of George H. Flinn Corp. since its incorporation. A veteran in the field of heavy construction, Mr. Lee is completing two large subway contracts in Brooklyn.



VETERAN CONTRACTOR, COL. GEORGE B. WALBRIDGE, vice-president and general manager of Walbridge, Aldinger Co., of Detroit, has been elected president of Detroit City Plan Commission, a post that carries with it membership in the Wayne County (Mich.) Board of Supervisors. For many years Col. Walbridge has been prominent in the affairs of the Associated General Contractors of America in which he served as president in 1925.



NEW YORK BUILDING CONGRESS elects new president, MAX H. FOLEY, to succeed Thomas S. Holden who has retired after several years of service as head of the organization. Mr. Foley is a member of the architectural firm of Voorhees, Walker, Foley & Smith, of New York City.



NEW PRESIDENT of New England Road Builders' Association is OVID F. WINSLOW, of the firm of Winslow & Cummings, road-building contractors, of Nashua, N. H. A former highway commissioner of Nashua, his home city, Mr. Winslow has recently completed highway contracts at Troy, N. H. ($126,000); St. Albans, Vt. ($350,000); and Newburyport, Mass. ($115,000). In past years he was chairman of the New England Sand and Gravel Commission for Maine, New Hampshire and Vermont.



NEW CHIEF ENGINEER of Wyoming State Highway Department is C. F. SIEFRIED, recently appointed by Frank Kelso, state highway superintendent. Mr. Siefried has served the department for 20 years in the capacities of chief draftsman, engineer of plans, superintendent-engineer and office engineer.

New trucks give Bonus Performance

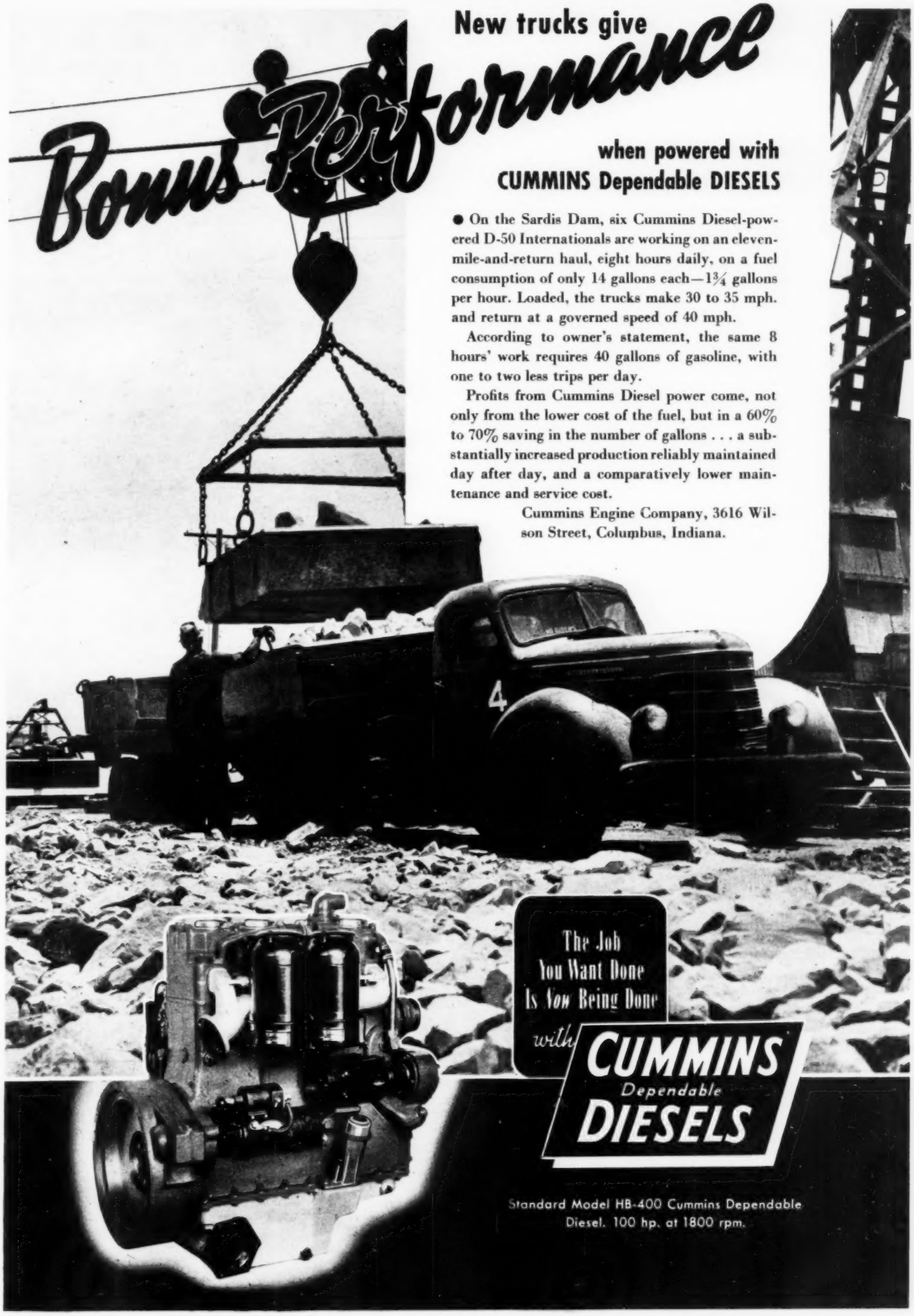
when powered with CUMMINS Dependable DIESELS

● On the Sardis Dam, six Cummins Diesel-powered D-50 Internationals are working on an eleven-mile-and-return haul, eight hours daily, on a fuel consumption of only 14 gallons each—1¾ gallons per hour. Loaded, the trucks make 30 to 35 mph. and return at a governed speed of 40 mph.

According to owner's statement, the same 8 hours' work requires 40 gallons of gasoline, with one to two less trips per day.

Profits from Cummins Diesel power come, not only from the lower cost of the fuel, but in a 60% to 70% saving in the number of gallons . . . a substantially increased production reliably maintained day after day, and a comparatively lower maintenance and service cost.

Cummins Engine Company, 3616 Wilson Street, Columbus, Indiana.



The Job You Want Done Is *Now* Being Done with CUMMINS Dependable DIESELS

Standard Model HB-400 Cummins Dependable Diesel. 100 hp. at 1800 rpm.



BROTHER!

HERE'S THE WAY TO CLIP WIRE ROPE WITH A *FIST GRIP*... NOT A ROPE CRIMPING "FINGER-PINCH"

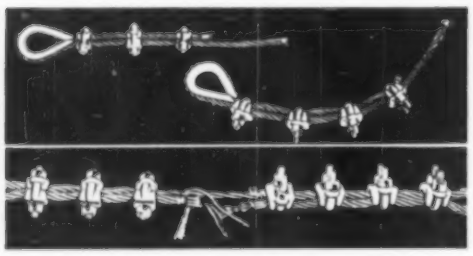
Laughlin drop forged Safety Clips *grip* around wire rope like a *fist* — the rope stays straight — uncrimped — can be used again when the clips are removed.

None of the narrow "finger-pinching" you get with ordinary U-Bolt clips which bow the wire — crimp it — and eventually break it.

Write for free booklet describing tests illustrated below. It will show you how to save on both rope and clips. Use handy coupon below – and mail it today!

YOU NEED FEWER CLIPS

Use 3 Laughlin Safety Clips instead of 4 U-Bolt clips — get the same strength.



OVER 95% ROPE EFFICIENCY

Tests like this—made by a famous engineering school — proved Laughlin Safety Clips delivered better than 95% rope efficiency.

THE THOMAS LAUGHLIN CO.
Portland, Maine

Send me free Safety Clip booklet. B-7

Name .....

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Check here for catalog on items below ☐

Look for Laughlin products in Thomas' Register and buy through your distributor.



CONSTRUCTION EQUIPMENT NEWS

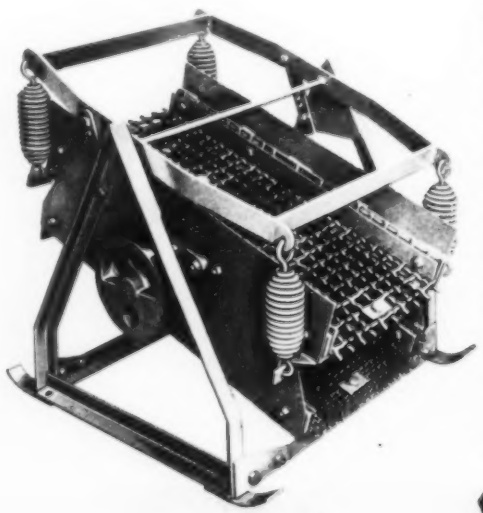
(ALL RIGHTS RESERVED)

Review of Construction Machinery and Materials for AUGUST, 1940

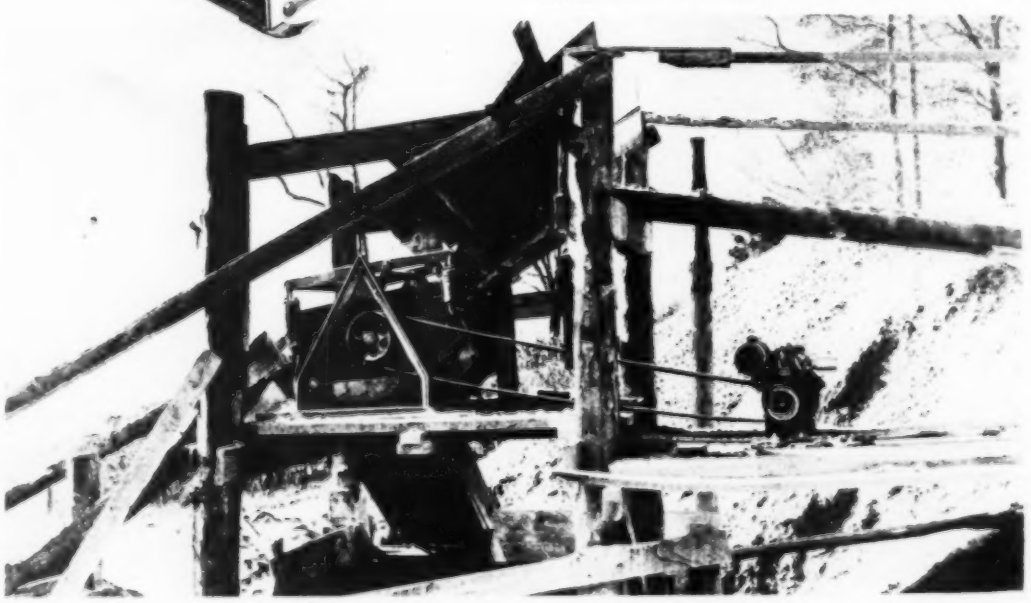


PORTABLE SMALL BITUMINOUS PLANT built for limited paving, resurfacing, patching, general maintenance, tennis courts, driveways and alleys, feeds itself, dries aggregate, heats bitumen, accurately proportions aggregates and bitumen and delivers homogeneous mass either to trucks or wheelbarrow. Capacity, 200 to 300 tons per day. Consists of two units, mixer and drier, each of which may be towed at truck speed. Mixer operates either with or without drier. Pugmill discharges directly into wheelbarrows or may be set up with an accessory conveyor for elevating material into trucks. Drier is fed either by small dragline which operates from mixer power unit or by other means. Self-operating and said to deliver any desired type of mix. Steam-jacketed pugmill.—**Barber-Greene Co., Aurora, Ill.**

★ ★ ★



CONTRACTORS SCREEN for use in accurate sizing and salvaging of crushed stone, sand and gravel, marble and slate chips, cinders, slag, coal, coke and other bulky materials is recommended for roadside plants, small quarry operations, building construction jobs, concrete block makers' plants, foundation and bridge abutment and other concrete work. Features: (1) Easily installed and transported; (2) driven by 2-hp. gasoline engine or 1-hp. electric motor; (3) three sizes at 100 tons per day; (4) rugged design and construction; (5) adjustable slope; (6) low maintenance cost — said to be less than ¾c. per ton including interest, power, screen cloth replacement and depreciation. Size of screening surface, 16 in. wide by 36 in. long. Weight, 400 lb. Motion, circle throw, uniform over entire surface. Vibrator, unbalanced weight type. Double row, self-aligning roller bearings. Lubricated by two pressure fittings. V-belt transmission. Speed, 1,000 r.p.m. Four suspension springs are steel wire coils which insulate vibration from structures. Welded structural steel frame. — **Robins Conveying Belt Co., Passaic, N. J.**



MAKE YOUR BOOKINGS *NOW*

for

SINEWS OF STEEL

BETHLEHEM'S NEW WIRE ROPE MOVIE





Bethlehem's recently completed movie on wire rope manufacture will prove interesting and informative for a distributor get-together, a meeting of an engineering or industrial group—or for any gathering of people interested in knowing how the wheels go 'round in the nation's basic industry.

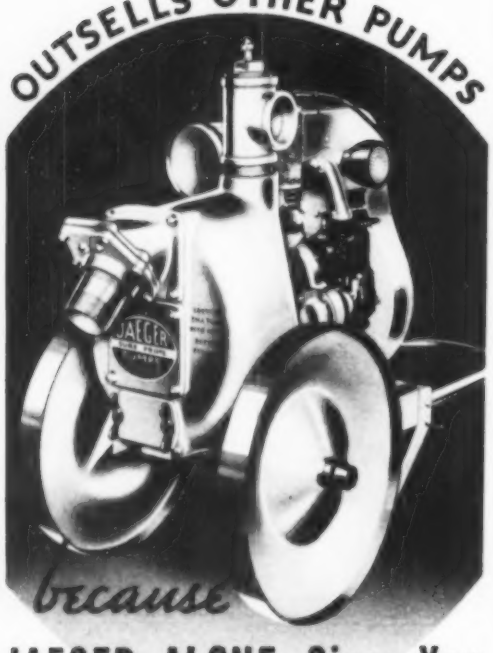
It is a graphic portrayal of Bethlehem's million dollar mill improvement plan, carried out in order to increase still further the quality and uniformity of Bethlehem Wire Rope. You see the new, modern equipment, including the giant machines that make the largest sizes, busily at work turning out Purple Strand and other Bethlehem Ropes.

"Sinews of Steel" is an adventure in one of America's largest workshops—the steel and wire-rope mills of Bethlehem Steel Company. The picture gives a swift, vivid portrayal of the steel-making process, shows how the wires are drawn from rods, then woven into sinews of steel. You see tons of white-hot metal pouring from huge ladles. You see giant rolling mills squeezing ingots like cheese. You see high-speed wire mills reducing rods to thread-like high-strength wire. You get the exciting inside story on how Bethlehem builds wire rope for every type of job.

Don't miss "Sinews of Steel." If you'd like to show it before any sort of actively interested group write to Bethlehem Steel Company, Bethlehem, Pa. Bookings are now being arranged throughout the country.

BETHLEHEM STEEL COMPANY

BETHLEHEM STEEL



JAEGER, ALONE, Gives You All These Pumping Features

JAEGER "PRIMING JET" — Up to 5 times faster priming and re-priming — often means difference between profit and loss on job. No adjustments — no need to "gun" engine.

POSITIVE RECIRCULATION CUT-OFF — It's controlled by flow, not pressure.

"FULL-RANGE" IMPELLER gives high efficiency under all conditions (built of steel in 4" to 8" sizes).

ACCESSIBLE SEAL — always outlasts the impeller.

PATENTED SELF-CLEANING SHELL — scours while pumping, won't clog, easily accessible.



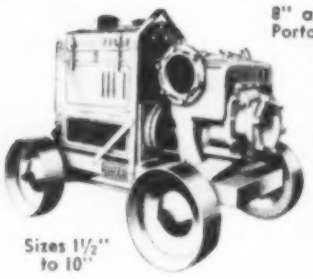
DEPENDABLE, LONG LIFE CONSTRUCTION — thousands of EXTRA hours of service.

EVERY PUMP INDIVIDUALLY TESTED for capacity and pressure before it leaves our factory.

Only $85 f.o.b. Factory — 3000 Gallon Bantam.

Send for Prices and New Catalog Describing Complete Line of World's Champion Sure Prime Pumps:

Compact 2", 3", 4" and 6" Sizes —Heavy Duty and Intermediate Types.



Sizes 1½" to 10"

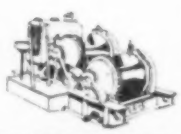
8" and 10" Sizes, Most Portable Big Pumps on Market — Capacities to 220,000 G.P.H.

Convertible Jetting - Dewatering Pumps (Two Pumps in One). Vertical Caisson Pumps, Well Point Systems, Triplex Road Pumps.

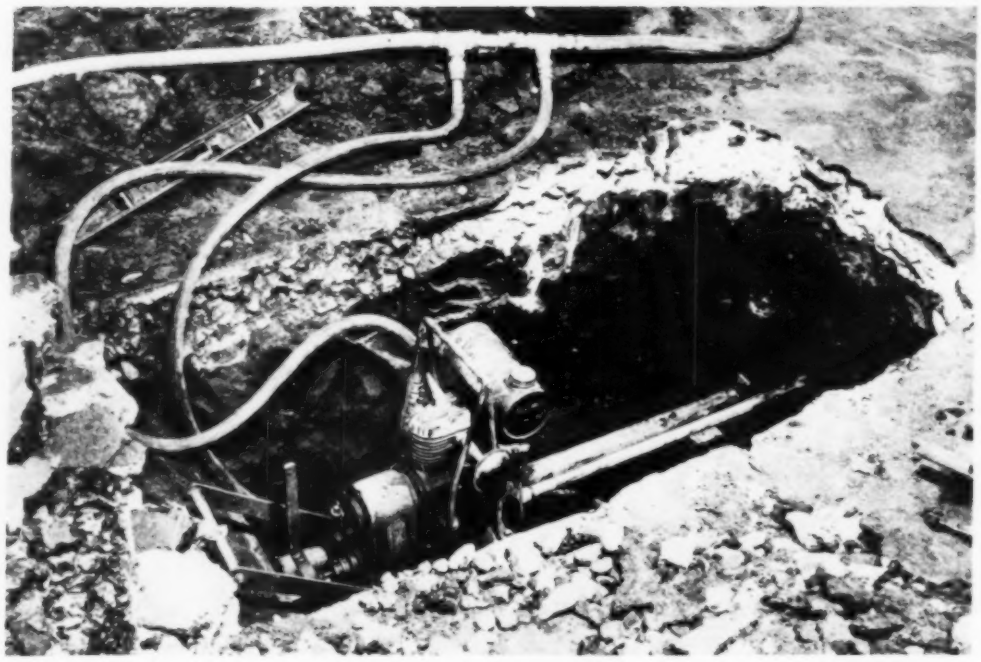


MIXERS Tilting, Non-Tilt, 3½S to 56S

HOISTS 6 to 100 H.P.



THE JAEGER MACHINE CO.
800 Dublin Ave., Columbus, Ohio



PORTABLE BORING MACHINE. for use in installation of water pipes and other service connections, requires 4-ft. long trench in which to operate and drills 2½-in. horizontal hole. When adequate trench has been opened, track is placed in direction and at grade desired. Water is turned on and boring is begun by placing clutch lever in forward position and manual feed lever forward. When unit reaches front end of track, water is turned off, machine is moved back, another drill stem is added, water is turned on and process is repeated. Powered by small gasoline motor. One-man operation. One utility company's records said to show from 900 to 1,300 ft. bored on 1 gal. of gasoline.—**Lube Jack Co., Santa Monica, Calif.**

★ ★ ★

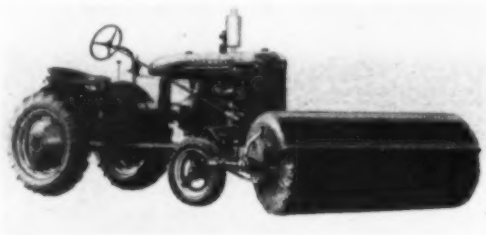
SAFETY BLASTING PLUG, consisting of a soft thimble-shaped rubber cup and a conical wooden wedge which is rammed into its open end to expand it and insure a snug fit against the rock walls of a drill hole, is designed as a substitute for tamping or stemming and is claimed to increase greatly the effectiveness of the explosive charge. These



Heitzman plugs come in standard sizes from 1¼ to 2¾ in. in diameter; larger sizes up to 6-in. diameters are made on special order. After placing the explosive charge in the drill hole the plug, ⅛ in. smaller in diameter than the hole, is pushed down directly above the charge and followed with the wooden wedge. The wedge then is tapped with a tamping stick to expand the rubber cup and seal the hole. Advantages claimed for the plug are these: Saves 75 per cent of time ordinarily required for stemming hole; increases efficiency of explosive by producing complete rock breakage to bottom of hole; works better than ordinary stemming under wet conditions; reduces accidents from misfires.—**The Heitzman Co., Lawson Building, Glendale, Calif.**

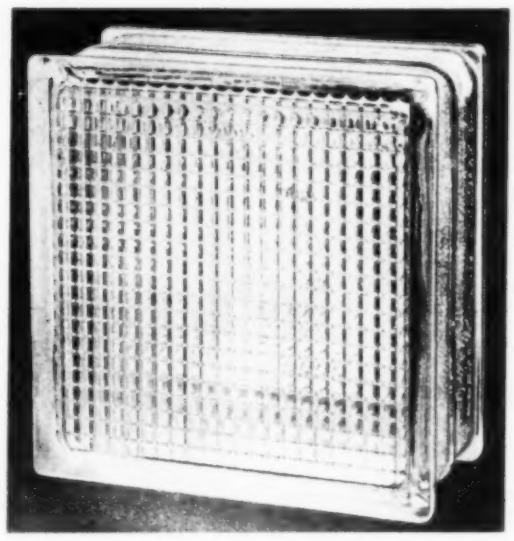
★ ★ ★

ONE-WAY SWEEPER, with 30-in. diameter broom, 72 in. long, for use with McCormick-Deering Farmall tractors, is designed for earth and leaf sweeping, for removing lines from black top subgrade, for snow removal and for general cleanup work on construction jobs, public works projects, municipal, airport and industrial operation. Advantages claimed by maker: high efficiency, flexible operator control, easy brush lift and adjustable broom pressure. Automatic torque tube drive from rear power take-off is carried below tractor to gear box behind broom where power is converted right and left to heavy-duty roller chain drives on both sides of broom. Dust hood confines float dust and protects equipment and operator. Sweeps 60-in. path and operates at approximately 1/10 of engine speed.—**Frank G. Hough Co., Libertyville, Ill.**



★ ★ ★

NEW GLASS BUILDING BLOCK that refracts sunlight in such a way as to lessen glare, contains interior horizontal prisms which break up sunlight incident at angles of from 30 to 60 deg. above horizon so that largest possible percentage of light is



transmitted upward. From ceiling this sunlight is reflected downward to provide relatively uniform distribution of daylight thoughout moderate sized rooms. Makers claim that new prism, light-directing blocks affords highly effective control of sunlight, satisfactory transmission of incident light; minimum of glare and permanent efficiency since prisms are sealed within block where they are free from dust.—**Pittsburgh Plate Glass Co., Grant Bldg., Pittsburgh, Pa.**

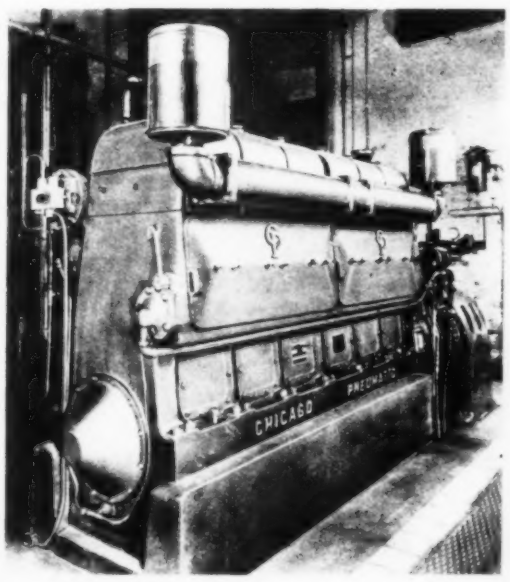
EXTRA HEAVY-DUTY TRUCKS with ratings from 3 to 10 tons and with maximum gross capacities ranging from 22,500 to 36,000 lb. are generally similar in construction but allow choice of power plant, brakes and rear axle size and type to meet various operating conditions. Features: (1) "Tocco"-hardened crankshaft journals, said to be virtually wear-proof; (2) counterbalanced crankshaft said to reduce vi-



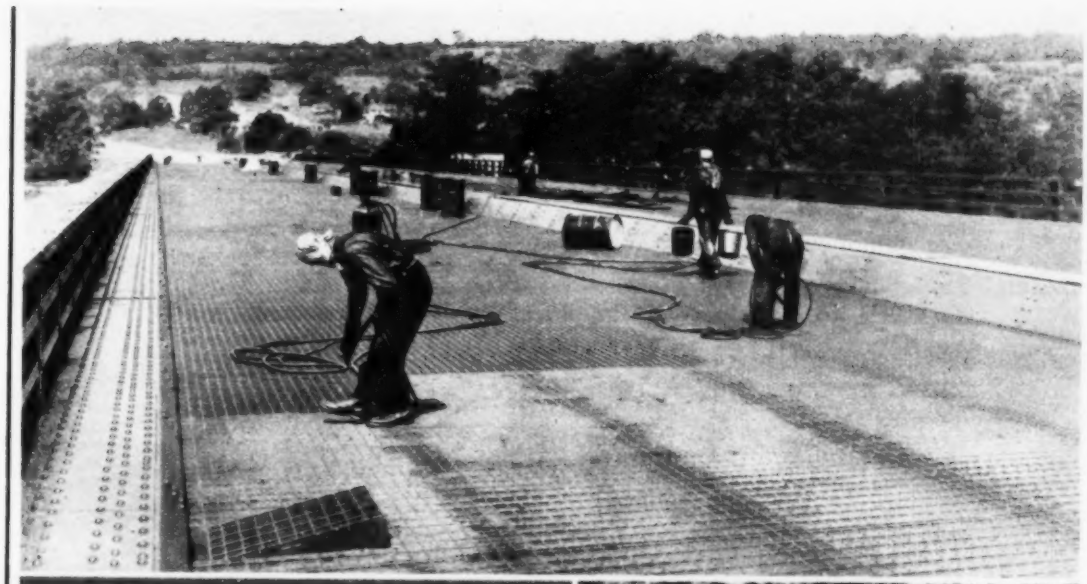
bration and to lessen main bearing loads; (3) "Clear-Floor" transmission permits easy access to driver's seat from either cab door; (4) hydraulic brakes have non-warping, non-scoring alloy iron brake dums, 5/16-in. molded lining and are powered by Bendix BK vacuum booster; (5) Chrome-molybdenum-nickel-iron motor block; (6) Driveshaft intermediate bearing consists of heavy-duty double-thrust roller bearing mounted in live rubber under permanent compression; (7) armored wiring; (8) full-depth cylinder cooling; (9) large center-mounted water pump; (10) Zollner light alloy pistons; (11) cushion-cradle engine mounting said to absorb torque reaction as well as periodic vibration; (12) cam-and-lever steering, roller bearing type.—**Diamond T Motor Car Co., Chicago, Ill.**

★ ★ ★

STATIONARY DIESEL ENGINES, designated as Types 8 and 9, are four-cycle, direct-injection units in sizes from 60 to 400 hp. designed for continuous, medium-speed, heavy-duty service. Available in 3-, 4-, 6- and 8-cylinder models. Combustion chamber shape, location of streamlined inlet valve and fuel injection system are correlated to give high com-



bustion efficiency. Valve passage promotes rotary swirl during intake stroke, resulting in complete mixing of fuel and air. All wearing parts are inclosed by dust-tight covers. Lubrication is entirely automatic—no hand oiling or greasing. Instant starting is provided by valve admitting compressed air to distributor which times flow of air to each cylinder. Cylinders have liners of cast nickel-chromium iron, ground and honed inside. Other features include: Individual fuel pumps, one to each cylinder; water-jacketed exhaust manifold; Bosch type fuel injection nozzles; inlet and exhaust valves with removable seat inserts and double valve springs.—**Chicago Pneumatic Tool Co., 6 East 44th St., New York, N. Y.**

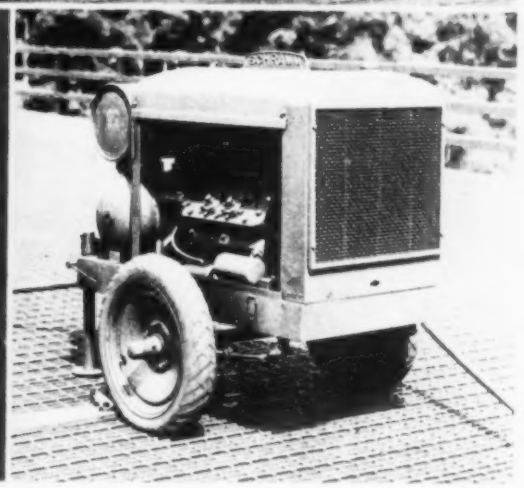


2000 Feet of Bridge Deck, Open Steel Mesh Construction Must be Painted

2 SCHRAMM "FORDAIR" COMPRESSORS

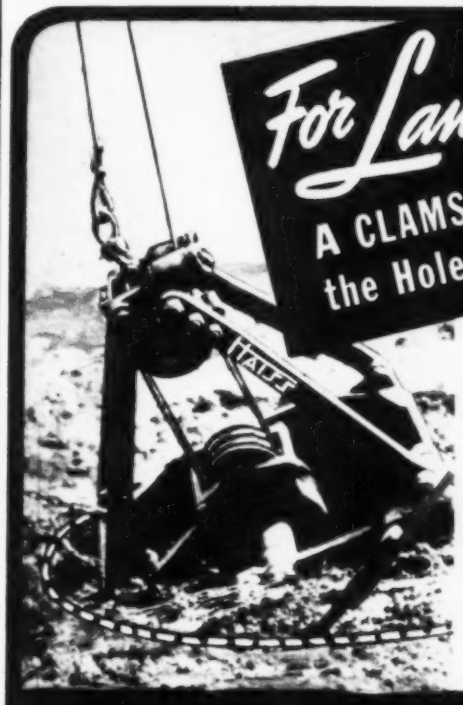
with 8 Spray Guns Did the Job

SCHRAMM, INC.
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902 E. Virginia Ave. West Chester, Pa.



For Landscaping

A CLAMSHELL . . . that Fits the Holes that Fit the Trees.



This Tree Planting Hi-Power (4'-10" lip to lip, open) digs a hole of just the right size. No waste effort. Max. economy in top soil required for backfilling . . . A typical Haiss Hi-Power, it *"digs like a badger"*—down, out of sight in the twinkling of an eye . . . Haiss Hi-Powers can be had in all sizes. Write for catalog and prices.



HAISS Hi-Power

FOR PAY LOAD CLAMSHELL DIGGING

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GEORGE HAISS MFG. CO., INC., 139th ST. & CANAL PLACE, NEW YORK—DISTRIBUTORS EVERYWHERE

LOAD THE BORE HOLE *right*



Loading is safer, quicker, simpler when you use Primacord, for no blasting cap is required in the bore hole.

Lower a properly laced cartridge slowly and smoothly to the bottom of the hole. As soon as it reaches the bottom, cut the Primacord from the spool, allowing proper length for joining to the main line. Draw the fuse taut and secure with a stone for the rest of the loading and tamping.

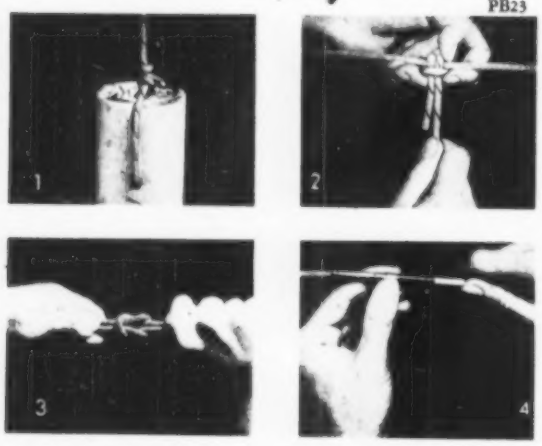
Deckloads are extremely simple. The Primacord loads from top to bottom of the bore hole through all deckloads.

The Primacord Booklet gives full information on the use of this modern, instantaneous blasting fuse. Send for your free copy today.

THE ENSIGN-BICKFORD COMPANY
Simsbury, Conn.
Makers of Cordeau-Bickford Detonating Fuse — and Safety Fuse since 1836

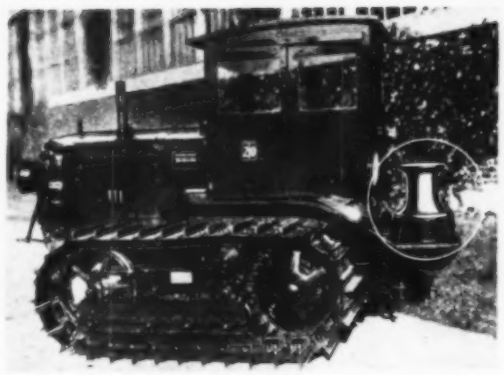
PRIMACORD-BICKFORD *Detonating* FUSE

PB23



1. Tie through cartridge.
2. Half hitch branch to main line.
3. Connect main line lengths with square knot.
4. Fuse and cap on end of main line.

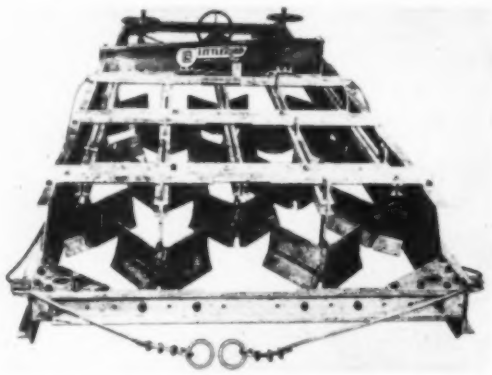
Important: Branch lines should lead away from main lines at *right angles*. Avoid kinks and small loops.



POWER-DRIVEN WINCH mounted on rear of tractor said to take care of many jobs where manila rope is used in handling, hauling or hoisting loads. This type of winch was used in United States Antartic Expedition, headed by Admiral Richard E. Byrd, enabling men to unload U.S.S. North Star, first expedition boat to arrive at Antartic.—**Winch Division, Gar Wood Industries, Inc., Detroit, Mich.**

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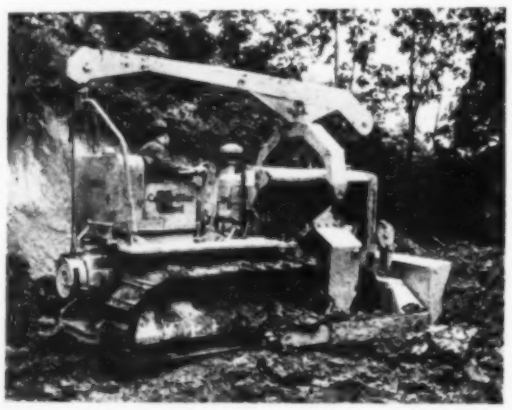
IMPROVED BITUMINOUS RESURFACER rides on two equalizing runners between which are several rows of small mixing units that pass materials back and forth until they are thoroughly mixed, thus eliminating all segregation. Center screed strikes off



mixed materials leaving smooth surface ready for roller. Resurfacer is said to apply mixed-in-place top courses in one or more layers, to correct excessive crowns by applying wedge courses, to spread and level plant-mixed materials, to do extensive mixed-in-place patching and to mix patching materials on road and windrow them. Only one pass of resurfacer claimed to be necessary.—**Littleford Bros., 443-457 E. Pearl St., Cincinnati, Ohio**

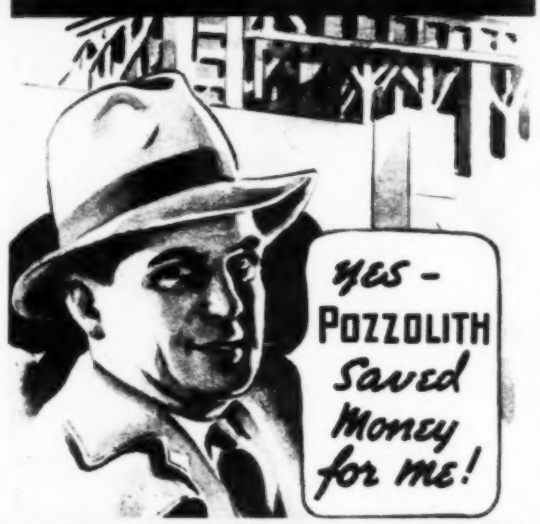
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SINGLE DRUM, REAR MOUNTED CABLE CONTROL for use on Caterpillar track-type tractors said to make possible more efficient control of bulldozers, trailbuilders and similar single-cable-operated equipment. Features: convenience and accuracy of



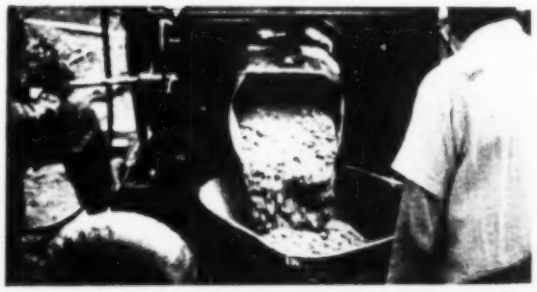
operaton. Control lever located at forward right-hand side of operator said to permit full attention to work from most natural and comfortable position. With lever in center position, drum is locked in neutral (brake on); drawn in toward operator, drum reels in cable; moved away from operator, drum allows cable to unreel. Lever position adjustable to suit operators. Attachment or removal claimed to be quick and easy. All adjustments, external, easily accessible.—**Caterpillar Tractor Co., Peoria, Ill.**

CONTRACTORS WILL TELL YOU -



POZZOLITH

saves money for contractors because when added to concrete — (1) It creates greater placeability of the concrete, particularly around a maize of reinforcing steel. It actually increases a 2" slump to 6" without added water. At equal slump or workability it cuts water and increases strength 25% or more. (2) It reduces expensive pointing-up and rubbing. (3) It checks honeycombing, segregation, bleeding. (4) It creates a more efficient flow in "pump-crete," and a greater uniformity; reduces the hazard of line stoppage when "pump-crete" is temporarily halted. (5) The most effective "water-proofer"; Pozzolith, by reducing the water needed, produces concrete of minimum porosity, shrinkage, cracking; giving far greater impermeability.



"Concrete is designed for a strength of 3500 pounds. Master Builders Co. Pozzolith is being used in the concrete, in the proportion of 2 pounds to the bag of cement, which has resulted in savings, and because of increased workability has eliminated honeycombing and similar difficulties." **From July, 1940, issue of Public Works, page 36.**

Mr. Contractor—With High Early Pozzolith and regular cement, you can produce high early strength for less money. Send for details.

THE MASTER BUILDERS COMPANY
Cleveland, Ohio **Toronto, Canada**

MASTER BUILDERS

Compressed Air Methods

Control Sinking of Four-Cylinder Caissons

(Continued from page 59)

process, guide frames attached to the four-shaft caissons steadied the huge steel assemblies, weighing up to 475 tons each, against bumpers on the sides of two derrick boats anchored securely in position.

During a portion of the sinking operation, the four-cylinder caissons were in a condition of unstable equilibrium, and four lifting lines attached to the frames were kept at constant tension by means of contractor-built indicators to counteract any tendency toward overturning. An accompanying chart indicates air pressures and air volumes at various stages of the sinking of pier 14 caisson which landed at El. –56. Pier 15 caisson, sunk to El. –72, had bell bottoms of the same size as those of pier 14, shown on the plan, while four-cylinder caissons for piers 19 and 10, which landed at El. –49.5 and El. –34, respectively, had 24-ft.-diameter open-bottom bells. Accompanying photographs illustrate typical flotation and sinking operations for the fourth and final four-shaft caisson, of pier 10, set in position May 8 over protruding steel-pile clusters on a submerged timber platform 10 ft. below river bed.

Steel Pile Foundations

All river piers, including the four quadruped caissons and sixteen two-post caissons, rest on steel H-piles driven to rock and protruding 10 to 17 ft. into the base concrete. The piles were driven through fabricated timber platform supported on wood piles driven under water and cut off to grade by a 4-ft. circular saw mounted in a sliding I-beam in the leads of a converted piledriver. These platforms required as many as 162 piles up to 90 ft. in length.

To drive the steel piles, both plumb and batter, running up to 194 ft. in length, the contractor mounted a 90-ft. all welded steel A-frame equipped with extensible pendulum leads and a special 16-ton single-acting steel hammer on the front end of the steam derrick boat *Chief*, as described in *Construction Methods*, September, 1939, page 63. The telescopic leads can be raised 60 ft. above the top of the tower and lowered 95 ft. below the deck, and they can be inclined to either side on batters up to 1:4. A 135-ft. boom on the derrick handled the long piles from barges to the leads.

This piledriver put down 938 steel piles for the twenty piers, and, in addition, drove long H-piles for trestle bents 46 to

(Continued on page 80)

Corrugated

STEEL SHEET PILING HAS MORE LIVES THAN A  !

● And that's putting it conservatively. You can re-use Corrugated Piling again and again on such jobs as sewers, cofferdams, building excavations, etc. One contractor used the same piling more than 100 times and many others report continued re-use, always with satisfactory results.

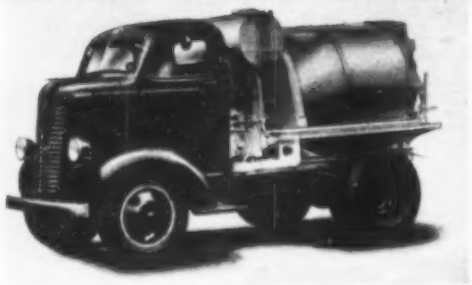
High salvage value is but one of Corrugated's features contributing to lower job costs. This piling is cold rolled from open hearth steel and has a tensile strength of approximately 45,000 lbs. per square inch. It is light in weight; easily handled; can be driven speedily either by hand or with power equipment; and is designed to produce a watertight construction.

Corrugated Steel Sheet Piling is available in varying gauges and lengths up to 30 ft. Write for complete information—now!



THE UNION METAL MANUFACTURING CO.
CANTON, OHIO

CUT THE COST OF READY MIXED CONCRETE



BUY THE TRUCK MIXER WITH THESE

REXCLUSIVE FEATURES

1 Rex Man-ten Cone-End Mixing Drum—gives 100% thorough mix without need of "throw-back" blades. Positive, end-to-end mixing action.

2 Rex Positive Shock Absorbing Flexible Chain Drive—better than 98% efficient! Far lighter, far more shock absorbent than any gear-type drive in the business!

3 Rex Full-Floating Rear Drum Mounting: non-flanged, Timken Equipped Drum Rollers eliminate destructive end play!

4 Rex Front Drum Mounting—a Rex double row self-aligning ball bearing, absorbs end thrust and kills end play before it has a chance to start!

5 Rex Automatic Overflow Water Tank—with new Rex Nozzle Closers, 100% foolproof, discharging into center of drum through one nozzle!

Ask About the Rex Time Payment Plan

Now you can buy Rex Moto-Mixers and pay for them as the money comes in! Send today for complete details about the Rex time payment plan. Ask for catalog, too! Address the Chain Belt Company, Dept. MM-8, 1664 W. Bruce Street, Milwaukee, Wisconsin.

BUY REX-MOTO MIXERS AND BE RIGHT!

(Continued from page 79)

59. A total of 59 five-pile and ten-pile bents were installed to carry I-beam spans from the Virginia shore to the first river pier.

Specifications permitted only one splice per pile. Each spliced pile was made up of one 115-ft. length and another section as long as needed to satisfy length requirements determined from borings at the piers and from driving ten test piles, up to 215 ft. long, in the trestle bent area. At splice points, the ends of the H-beams were milled square, and the splices were made with plates riveted to the webs and angles riveted to the flanges.The piles were driven short section downward, and pile points were reinforced with plates and angles.

Two-Post Caissons—Derrick boats placed the two-cylinder caissons for sixteen piers. Twelve of the caissons were fabricated complete, three were made up in two sections with flanged horizontal joints bolted together under water by divers, and one was fabricated in three sections.

14,000 Tons of Steel — In all, the job required 37½ mi. of steel H-piles, weighing 7,750 tons. Including steel caisson shells and steel reinforcement, the total quantity of steel in the substructure amounts to 14,000 tons, exceeding in weight the 13,000 tons of structural steel in the superstructure and equaling the weight of all superstructure steel, including 1,000 tons of grid reinforcement for the concrete-filled roadway 24 ft. wide. Substructure steel was supplied by the Carnegie-Illinois Steel Co.; the American Bridge Co. fabricated the caisson shells and long piles at a railhead and dock at Pope's Creek, Md., 2 mi. above the bridge.

Progress

Construction at the bridge site really started with the arrival of the big floating piledriver *Chief* on June 28, 1939. Piledriving was finished April 2, 1940. The first two-post pier caisson was placed Sept. 12, 1939, and the first four-cylinder caisson, for pier 14, November 21, the actual sinking taking only 3 hr. Operations were halted by winter for nearly seven weeks during which a tug trammeled river ice around pier 15 four-legged caisson, placed January 16, to keep the unfilled shell from being crushed. The final four-shaft caisson was lowered to position May 8, as already noted, and the last section of two-cylinder caisson was bolted in place May 13. Substructure work was completed June 1, just a little more than eleven months after the *Chief's* arrival on the scene.

A floating concrete plant equipped with two 1-yd. mixers placed 29,000 cu.yd. during this period, depositing all concrete below El. −10 by tremie. Other floating plant included five derrick boats of 100-, 35-, 25-, 15- and 10-tons capacity, a combined piledriver and cutoff saw rig, a floating revolving crane, two tugs and a score of barges. The working force comprised 177 laborers and mechanics, including seven divers.

Administration

A PWA grant and a bond issue of the Maryland State Roads Commission provided the funds for the $4,250,000 toll bridge, which is being built under the jurisdiction of the State Roads Commission with the J. E. Greiner Co., Baltimore, as designing and supervising engineers. Raymond Archibald is resident engineer for the engineering firm, and Gaither H. Sykes is resident engineer-inspector for PWA.

Operations of the Merritt-Chapman & Scott Corp., New York City, substructure contractor, were planned and directed by Frank W. Barnes, construction manager. Albert C. W. Siecke, office engineer, handled design details, and William Denny was superintendent in the field.

Erection of steel by the Harris Structural Steel Co., New York City, holder of a $2,000,000 contract for the superstructure, started at pier 14 early in May. Barring extreme weather conditions this fall, the fabricating and erecting firm expects to complete its contract before the end of the year.

* * *

Washington Airport Runways

(Continued from page 44)

place bituminous concrete given consideration during the preliminary studies. The mixed-in-place construction was ruled out from a design viewpoint because the hydraulic fill contains irregular strata of aggregate classifications, although the average gradation is good.

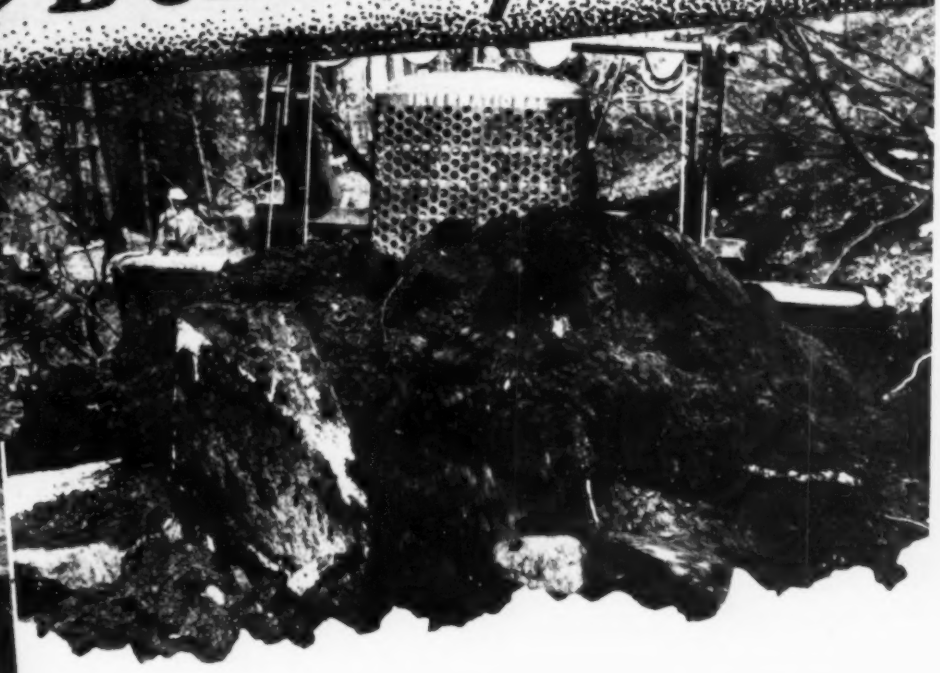
Pavement Design—Runway pavement is designed to take Douglas DC4 65,000-lb. transport plane loading with allowance for static load and 50 per cent maximum impact load. Pavement of this design is equally capable of taking the landing load of a 70-ton bomber, as the tires, barring failure, do not impose a unit pressure greater than about 65 lb. per square inch. Uncompacted sand-gravel fill (without superimposed pavement), such as is present under the stabilized bases of the runways, has a bearing value of 80 lb. per square inch (11,520 lb. per square foot), as determined by load tests.

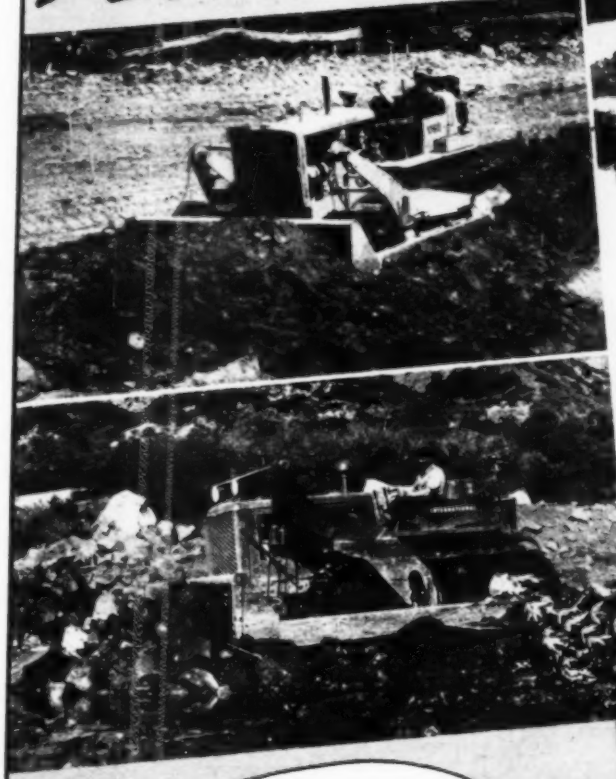
So long as airplane tires are not burst by a crash landing or by failure of the shock absorbers, the unit load on the pavement cannot greatly exceed the unit pressure in the tires. The impact of a severe landing may increase the total load by as much as 200 per cent without damaging either the shock absorbers or the tires and without materially increasing the unit pressure. As a safety factor, to take care of failures in shock absorbers or tires, the pavement designers made allowance for 50 per cent of the maximum impact load which would be applied by a 65,000-lb. plane under conditions involving jammed shock absorbers and ruptured tires.

Because airport runways do not get the benefit of the kneading action of frequent traffic such as is carried by highways, the design calls for use of a soft asphalt of 120-150 penetration to preserve the ductility of the asphaltic concrete and resist

(Continued on page 82)

Here's why Buckeye 'Dozers give you MORE YARDAGE PER DAY





BUCKEYE Cable Controlled Bulldozers and Trailbuilders have features found in no other equipment of their type — features that mean more yardage in less time and more profits for you: Plow-like digging action PLUS a blade curvature that rolls the dirt makes possible a higher mold board and bigger payloads with the same power. Blades "hug" front of tractor, reducing load and wear on front idlers and track rolls. Full floating blade, pivoted at drive end of tractor permits high lift and free swinging action up or down. Simple frame with no overhead members means less weight, greater visibility. No cylinders required for down pressure — full cable control with Buckeye G-L-T Power Control Units transmits full engine power for lifting action. Trailbuilder blades adjustable to any desired angle and on many models adjustable horizontally when angled to help equalize load and reduce uneven crawler wear. For maximum yardage at lowest cost, use Buckeye equipment to work with your tractors. Write for full information now. BUCKEYE TRACTION DITCHER COMPANY, Findlay, Ohio.

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Buckeye

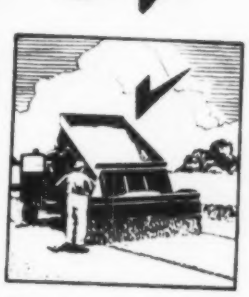

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Baker Two-Wheel Hydraulic Scrapers enable you to get your money's worth out of your tractors. They load 15 per cent easier because they dig at a flat angle — no wasted time or power — better grades and neater fills. Baker Scrapers come in 3, 4 and 6 cu. yd. capacities for any tractor.

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THE BAKER MFG. CO.
568 Stanford Avenue, Springfield, Illinois

BAKER

(Continued from page 80)

cracking. For the turnarounds at the ends of the runways, where a considerable amount of turning by planes will occur, with consequent twisting action of tires on pavement, a harder asphalt of 85-100 penetration is specified, and the pavement is slightly increased in thickness.

In addition to a more ductile asphalt to compensate for the lack of wheel travel, runway pavements require a larger percentage of asphalt than highway pavements. For the Washington Airport runways, specifications set the proportion of bitumen to total aggregate by weight at 5 to 7 per cent for binder course and 6 to 9 per cent for wearing course. Within these limits the actual proportion of bitumen is adjusted by PRA engineers in charge of the asphalt plant to fit the requirements of aggregate gradations as determined by sieve analyses. Typical binder course mixture, indicated by an accompanying tabulation for June 26, contained 5.7 per cent asphalt.

Temperatures of asphalt and of mineral aggregates are limited by the specifications to 200-325 deg. F. A similar temperature range is prescribed for batches discharged from the mixer. To avoid overheating the asphalt cement and thus reducing the ductility of the material, temperatures normally are held in a range of about 250 to 275 deg. By way of example, temperatures recorded by electric pyrometers for binder mixture on June 26 showed about 280 deg. for asphalt in the tanks, 250 to 275 deg. for aggregates in the weigh box, and 250 to 325 deg. for aggregates in boot at the foot of the hot elevator.

Aggregates Supply

Surcharged sand-gravel fill, deposited by dredge pipe lines above runway grade, was left in place at the east ends of the northeast-southwest and northwest-southeast runways as a stockpile to provide aggregates for the asphalt mixing plant, erected in the intersection between the runways. A Caterpillar 95-hp. diesel tractor and Le Tourneau 12-yd. scraper deliver sand-gravel from the surcharged areas to a grizzly over the feeder bin of an aggregate processing plant at this location. Excess material dumped by the scraper is pushed up to the grizzly by an Allis-Chalmers 45-hp. gasoline tractor equipped with a Baker bulldozer.

Aggregate Plant — To furnish graded aggregates to the asphalt mixing plant, the contractor set up an aggregate preparation plant which takes material by buck-

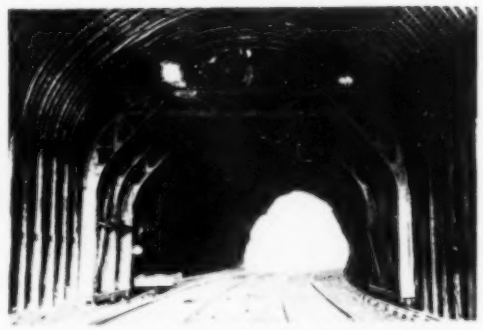
TYPICAL BATCH WEIGHTS
ASPHALTIC CONCRETE BINDER COURSE
JUNE 26, 1940

1¼-in. to ¾-in.	900 lb.
¾-in. to ⅜-in.	990
⅜-in. to No. 8	1,180
No. 8 to Zero	1,660
	4,730 lb.
Asphalt Cement	270
TOTAL	5,000 lb.

COMMERCIAL

GIVES YOU *EASIER, FASTER, AND SAFER* CONSTRUCTION ON...

. . . LARGE RAILROAD TUNNELS!



● As an example of the efficiency of COMMERCIAL products, this railroad tunnel was enlarged and lined with COMMERCIAL liner plates, ribs, wall beams and posts as temporary protection until concrete lining could be placed . . . and all this *without interruption to traffic*. Surely, such ability to "do the job", even under trying conditions, speaks volumes as to COMMERCIAL'S value as a time, money and labor saving tunneling method. Too, consider COMMERCIAL'S all-around efficiency — plates for every size tunnel. You'll find there's a COMMERCIAL Liner Plate for your next tunneling job. Write for details.

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ARMSTRONG



Only the best can be economical

In construction and structural wrenches only the best will do, for there's no controlling the stresses and strains one of these wrenches may be subjected to. That's why so many builders are standardizing on ARMSTRONG Wrenches. Drop Forged from special Carbon or Chrome Vanadium steels, they have deep and narrow jaws that take a secure grip on the nut and an extra long taper for ease in lining up bolt holes. Construction Wrenches with 15, 45 and 90° degree heads. Structural Wrenches (both open end and socket types) have off set heads to clear obstructions and keep head squarely on the nut. Milled openings from 7/16" to 2", Box Wrench from 1 1/16" to 2 9/16".

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Armstrong Bros. Tool Co.
"The Tool Holder People"
334 N. Francisco Ave., Chicago, U.S.A.
Eastern Warehouse & Sales:
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et elevator from a Stephens-Adamson reciprocating feeder under the feeder bin and sizes it by means of two Robbins Gyrex 5x12-ft. vibratory screens into classifications passing ¼-, ¾-, 1¼- and 2½-in. square openings. The reciprocating feeder and the vibratory screens are driven by electric motors.

Oversize gravel rejected by the 2½-in. screen is deposited in a 15-cu.yd. bin from which it is hauled away by U. S. Engineers' trucks. Material passing the 2½-in. screen and retained on a 1¼-in. screen is stockpiled in case it should be needed for crushing for wearing course mixture. The contractor receives payment for all non-usable aggregate, in excess of job-mix requirements, passing the 1¼-in. screen. This excess has been running about 25 per cent of the total passing the 1¼-in. screen.

When mixing binder course asphaltic concrete, the operators draw aggregates from the 1¼-, ¾-, and ¼-in. bins of the aggregate plant. These materials drop

AGGREGATE GRADATION FOR ASPHALTIC CONCRETE PAVEMENT, WASHINGTON NATIONAL AIRPORT

SCREEN SIZE, SQUARE MESH	PER CENT PASSING	
	Binder course	Wearing course
1¼-in.	100	—
¾-in.	60-95	100
⅜-in.	40-75	60-85
No. 4	35-60	50-65
No. 10	30-45	35-50
No. 40	10-25	15-30
No. 100	0-15	5-15
No. 200	0-5	5-8

Wearing course gradation shown is after introduction of approximately 15 per cent of crushed material and about 5 per cent of mineral filler.

MINERAL FILLER GRADATION

		Per cent
Passing 80-mesh sieve		100
Passing 200-mesh sieve	Not less than	75

through chutes on to Jeffrey electric vibratory feeders; by rheostat control, the amplitude of the pulsations of these vibratory feeders is regulated to supply the various gradations in proper proportions to the cold elevator charging the drier of the asphalt mixing plant.

Specifications required that the complete plant have a capacity of not less than 75 tons per hour computed at a rate of not more than 30 batches per hour per mixer. The requirement is met by a Warren Bros. 900 Series asphalt mixing plant equipped with a 5,000-lb. mixer; this plant is easily capable of producing 40 batches, or 100 tons, per hour. To satisfy another requirement of the specifications, the mixing plant has a 6x24-ft. drier revolving at a speed of about 10 or 11 r.p.m. and mounting a battery of five Gem burners capable of reducing contained moisture in the aggregates from 6 per cent to less than 1 per cent at a rate of 100 tons per hour when the atmospheric temperature is as low as 40 deg. F.

From the drier a bucket elevator raises

(Continued on page 84)



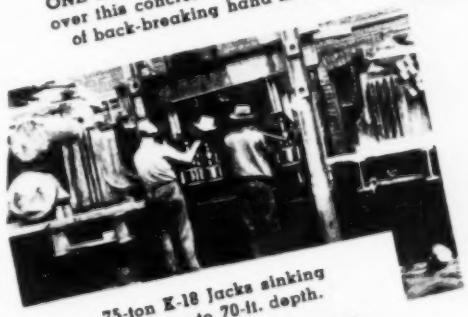
FA-27 does bridge shifting economically.



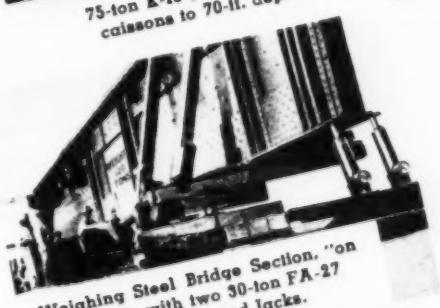
H-14 slips under clumsy loads and lifts 12 tons on toe.



ONE MAN operating a K-18 pushed over this concrete wall, saving days of back-breaking hand methods.



75-ton K-18 Jacks sinking caissons to 70-ft. depth.



Weighing Steel Bridge Section, "on the job", with two 30-ton FA-27 Gauge-Equipped Jacks.



Drawing Bridge Anchor Cable — Blackhawk Gauge-Equipped Jacks were used in constructing world's largest pontoon bridge over Lake Washington, Seattle, Wash.

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THAT BLACKHAWK HYDRAULIC JACKS CONSERVE MAN-POWER CUT DOWN TIME LOSSES

The pictures tell the story — proving how Blackhawk Hydraulic Jacks

SAVE TIME — because they're handier to use — positioned and operated quicker than mechanical types.

SAVE MAN-POWER—because they deliver 94% operating efficiency, as compared to 12% to 30% for screw-type mechanical jacks. One man easily lifts full load — frees extra men for other jobs.

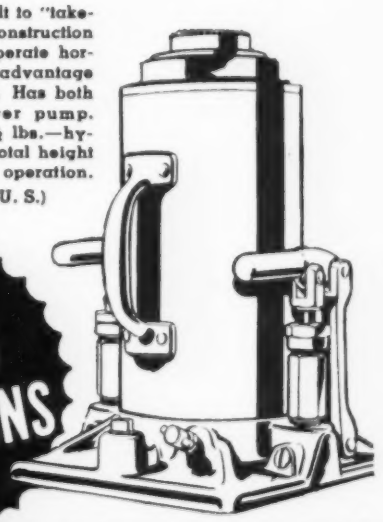
SAVE TROUBLE — No teeth to sheer and suddenly drop load. Positive control to 1/1000th of inch in both raising or lowering.

SAVE EXPENSE — because they pack more power per dollar than any other type — often pay for themselves on first big job.

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Dept. J2380, Milwaukee, Wis.

20-Ton EA-14. Built to "take-it" on toughest construction jobs. Can also operate horizontally—a great advantage in close quarters. Has both speed and power pump. Weighs only 69½ lbs.—hydraulic lift 9½", total height 23½"— one-man operation. $38.00 (East U. S.)



42 MODELS 1 TO 75 TONS

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Company_____

Address_____

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INTO HOPPERS OR BIG BUCKETS — OVER DIRT PILES INTO THE FORMS

FASTEST LOADING, FASTEST MIXING AND FASTEST HIGH DISCHARGING TRUCK MIXER ON THE MARKET . . .

NEW DRUM SIZES BOOST PAYLOAD

Latest development by world's largest mixer manufacturer — mobile 2, 3 and 4 yd. concrete plants that cut placing costs, deliver proven higher strength concrete. One-Shot Top Loading, 2-Speed Mixing, Vacuum Controlled Discharge, many other features. GET CATALOG, PRICES, EASY TERMS.

HIGH DUMP MIXERS
2, 3, 4 Cu. Yd. Sizes. 2 Yd. Size Mounts on Short Wheelbase Ford-Type Trucks

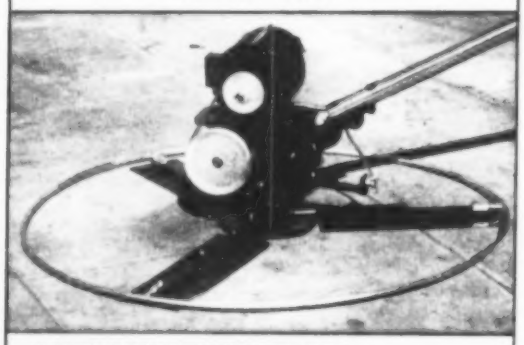




Also STANDARD HEAVY DUTY MIXERS
up to 5½ Cu. Yds. (7½ Cu. Yd. Agitators)

THE JAEGER MACHINE CO., 800 Dublin Ave., Columbus, Ohio

MULTIPLY the EFFICIENCY of Your Cement Finishers 75 to 100%



"PRECISION" FINISHER WILL SLASH COSTS AND TIME ON JOB

Your men will finish cement floors in one fourth to one half normal time and get more uniform, smoother surfaces, with the Whiteman Precision Cement Floor Finisher. This power-driven unit distributes coarse aggregate particles uniformly through the entire depth of finish preventing accumulation of laitance film and weak mortar. You get a dense, strong, wear-resistant floor free from maintenance and repair costs. For color work, this machine is unequalled — it presses color in uniformly and with even texture.

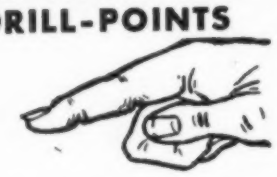
The Whiteman Precision Finisher is equipped with electric motor or gasoline engine. Rotates three-bladed feathering propeller with controlled pitch trowels and covers 46 inch span. Operates easily by handle control—Circular guard prevents accidents.

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DRILL CONCRETE 50-75% FASTER

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CARBOLOY
MASONRY DRILL-POINTS

(Continued from page 83)

hot aggregates to a Robbins Elliptex electric-motor-driven vibratory screen above the 50-ton bins of the mixing plant. The screen separates the material into gradations passing the 1¼-in., ¾-in., ⅜-in. and 8-mesh square openings.

Gates operated by hand levers pass the graded aggregates into the weigh box; the weights are indicated cumulatively by a Howe dial scale. Asphalt cement is measured in a weigh bucket.

Mixer Design

In the 5,000-lb.-capacity twin pugmill mixer, blades of the run-around type, equipped with larger than ordinary paddles, move the material back and forth in the mixer box and speed the mixing operation. The mixing period is controlled by an electric timing device made up of G-E parts assembled by the contractor. For both binder course and wearing course, the dry mix time is 15 sec. and the wet mix 45 sec.

Electric push buttons controlled by the timing device are pressed to start the electric motors which dump the weigh box and the mixer. On the narrow operating panel above the push buttons is an electric light connected with the time lock. It is impossible to dump the mixer until the light comes on, signalling the operator that the mixing operation is completed.

A recording device of the Brown Instrument Co. keeps continuous graphs of temperatures registered by three pyrometers: (1) in the steam-heated asphalt storage tanks; (2) in the weigh box; and (3) in the boot of the hot aggregates elevator. The various temperatures are recorded by curves of different colors on a continuous moving strip of paper.

Diesel Power — To operate certain mechanical units of the plant and to drive generators supplying electric power to others, the contractor employs three diesel engines, two Caterpillar D 13000's of 125 maximum b.hp. and one Atlas of somewhat less horsepower. The Atlas engine drives the reciprocating feeder under the feeder bin, the gravel plant elevator, and a Symons disk crusher used in producing aggregates for the wearing course, which requires introduction of not less than 15 per cent of crushed material.

One of the 125-hp. units drives the drier, the cold and hot elevators and a 30-kw. generator which supplies ample power for the vibratory feeders, for the asphalt plant screen and for lights. The second D 13000 engine turns the mixer and a 90-kw. generator which powers the aggregate plant screens, the electric timer and additional lights. Motors of the two aggregate plant screens are connected with this generator through a two-way switch which permits individual or multiple operation of the screens.

Asphalt Storage

Despite the fact that the mixing plant is located at waterside, offering a good competitive opportunity for barge shipment of asphalt to large volume storage,

(Continued on page 86)



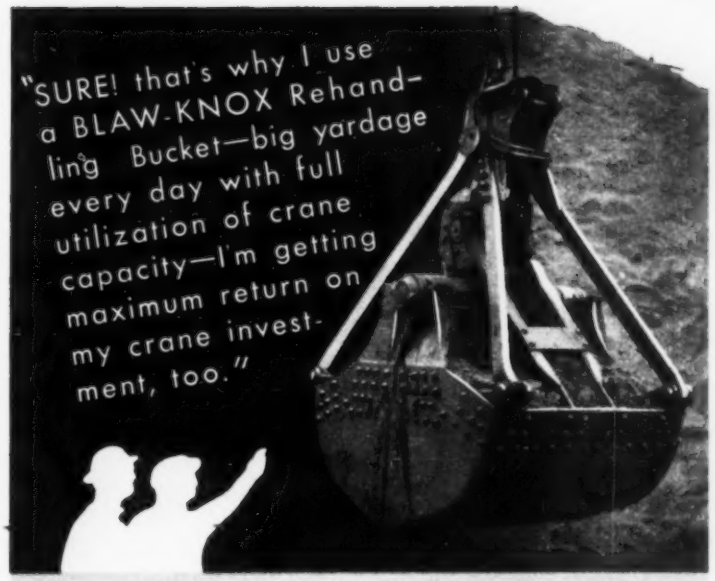
For compacting earth fills—the practical design of Blaw-Knox Sheepsfoot TAMPING ROLLERS appeals to contractors because they give uninterrupted service and meet all modern specification requirements.

The roller units are full floating, on husky frames—built for long, hard use.

Send for complete details and prices.

BLAW-KNOX DIVISION of Blaw-Knox Company
FARMER'S BANK BUILDING PITTSBURGH, PENNA.

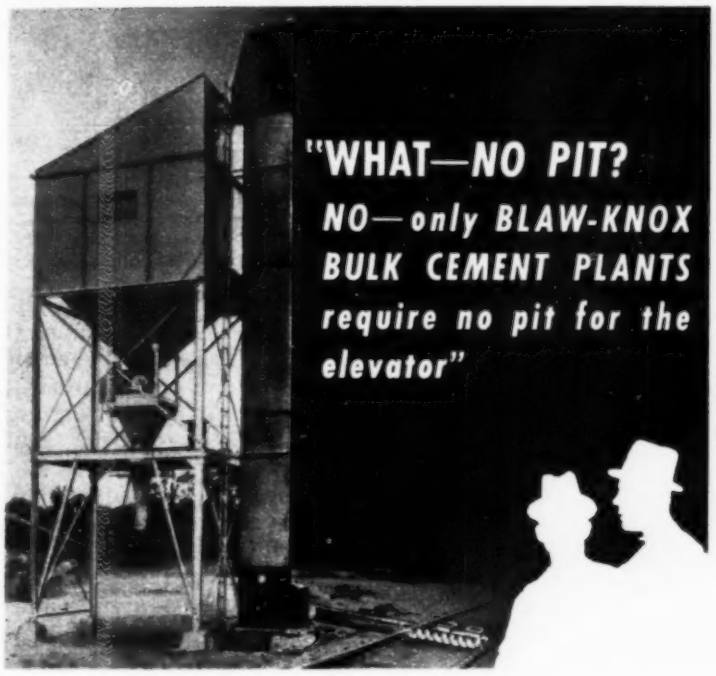
BLAW-KNOX
Sheepsfoot
TAMPING ROLLERS



Bulletin 1606 entitled Blaw-Knox Buckets for Contractors shows how to select a bucket to secure the profitable difference between peak and ordinary performance—it will be sent on request.

BLAW-KNOX DIVISION of Blaw-Knox Company
FARMER'S BANK BUILDING PITTSBURGH, PA.

BLAW-KNOX
REHANDLING BUCKETS



Blaw-Knox BULK CEMENT PLANTS are the ultimate in portability, speed, and convenience of use and operation. They are *complete units* for unloading, storage, batching and handling of bulk cement—dependable and accurate.

Completely described in Blaw-Knox Catalog No. 1566. Send for copy.

21

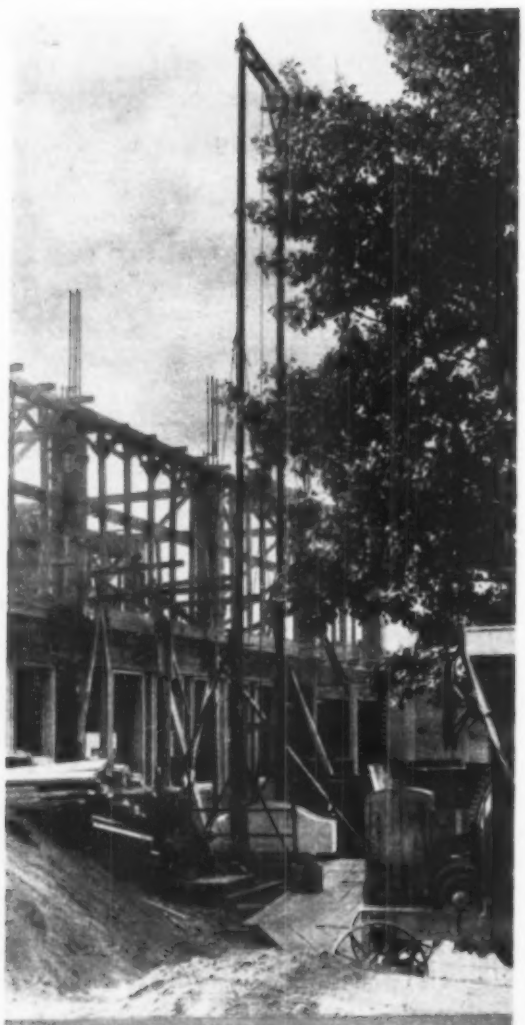
BLAW-KNOX BLAW-KNOX DIVISION OF BLAW-KNOX CO. Farmers Bank Bldg. Pittsburgh, Pa.
Bulk Cement Plants



Blaw-Knox Truck Mixer Loading Plants include overhead storage bins for aggregates and cement; accurate Weighing Batchers for aggregates, cement and water; arranged for manual or automatic operation; complete conveyors for handling materials from cars or trucks to bins, when desired—all properly designed and built to your requirements as an efficient unit for truck mixer loading. See Blaw-Knox Catalog No. 1582.

15.

BLAW-KNOX BLAW-KNOX DIVISION • OF BLAW-KNOX CO. • Farmers Bank Bldg. Pittsburgh, Pa.
TRUCK MIXER
LOADING PLANTS



CLYDE BUILDERS ELEVATOR

(Patent Applied For)

Cut building costs . . . step up your construction program with a new, Clyde portable Builders Elevator.

NO WASTE . . .

No costly scaffolding or ramps to erect and tear down. The Clyde Builders Elevator is a self-raising, self-contained unit that needs no guy lines or supports.

NO DELAYS . . .

The Clyde Builders Elevator can be moved from one location to another, as on large buildings or housing projects, in an upright position. Tower can be lowered in a very few minutes when necessary to clear overhead obstructions.

NO SPECIAL EQUIPMENT . . .

No extra tackle required for assembling or erecting. Elevator can be towed by truck or skidded under its own power. It can be quickly taken apart and loaded on a truck for transporting.

Write for prices and specifications.

CLYDE IRON WORKS, Inc.
DULUTH, MINN.

(Continued from page 84)

the material actually being used is California asphalt cement supplied by the American Bitumuls Co. and truck-hauled from Baltimore, about 40 mi. distant, to two 10,000-gal. tanks on the site. Fuel oil for the burners and diesel fuel oil for the power plants likewise are delivered by tank trailers, the former to an 8,000-gal. and the latter to a 6,000-gal. tank. An Erie Economic 99.9-hp. fire-tube horizontal boiler furnishes steam at 100-lb. pressure to heat the asphalt tanks and the steam-jacketed mixer box and to operate a Warren Bros. 4-in. rotary asphalt pump.

Contract Time

The paving contract held by the Warren Bros. Road Co. is divided into two periods, with a definite time limit of 130 calendar days set for the first and major period, at present in progress. Notice to proceed was given May 3, and the first period, involving 80,000 tons, or about 450,000 sq.yd. of pavement, must be completed Sept. 11, with a penalty of $500 per calendar day beyond that date. This period will complete all runways and main taxiways, about one-half of the apron in the vicinity of the hangar and terminal building, and some paving on access and service roads. The hangar and terminal building are expected to be ready to permit full commercial use of the airport, 130 schedules a day, by November. Quantity of pavement to be placed by the contractor during the second period of construction has been nominally estimated, for bidding purposes, at 20,000 tons.

About one month was required by the contractor to erect and organize the new asphalt mixing plant and to break in paving crews. The contract officer (U.S. Engineers) supplies to the contractor 50 WPA laborers and four foremen per shift, and each shift is set up on a basis of five 7-hr. days and one 5-hr. day, making a 40-hr. work week, in order to utilize this labor, although a 44-hr. week would otherwise be permitted. Two-shift operations were in use until June 27, by which time the organization had built up production to 500 tons per 7-hr. shift. On that date, the contractor added a third shift, increasing the total working force to 150 WPA laborers, twelve foremen and about 35 men engaged in supervision and skilled machine operation. A daily production of 1,500 tons is adequate to complete the first construction period by Sept. 11, with allowance for rainy days.

Truck Hauling

Four new Brockway trucks, with rear ends and springs designed to carry heavy loads, have their bodies built up with sideboards to carry three batches, 15,000 lb., from the mixer to two black top paving spreaders operating on the runways. Average one-way haul from the central mixing plant is ½ mi., and maximum haul is about 1½ mi. To dump their loads, the trucks back between the front wheels of the four-wheel-drive spreading machines, to which they are tied by ropes to maintain contact with the spreaders as the latter machines push the trucks forward during the spreading operation, thus avoiding the necessity of occasionally braking the trucks and placing undue tractive load on the spreaders' forward wheels and rear rollers, all of which are used for propulsion. This avoidance of braking eliminates tearing of tar prime by spreader wheels as result of increased tractive effort required to push braked truck.

Paving Equipment

Two Adnun black top pavers, more than capable of handling the maximum output of the mixing plant, spread the asphaltic concrete for each course in 10-ft. longitudinal lanes and strike off and partially compact the material. To obtain accurate grade superior to that obtainable by setting forms for the outside edge of each successive lane, the engineers have worked out a system of steel grade pins supporting a taut wire which guides a floating telltale



FLOATING TELLTALE riding on taut steel wire stretched over grade pins guides operator in adjusting strikeoff of spreading and finishing machine to produce uniform grade on each course.

on the offside of the machine, as indicated by an accompanying photograph. On the other side of the spreader, a shoe rides on the completed course of the adjacent lane. This method of setting grade gives unusually smooth pavement with minimum disturbance of the prime on the stabilized base and is unusually well adapted to sharp changes in pavement grade or contour, as at intersections or gutters.

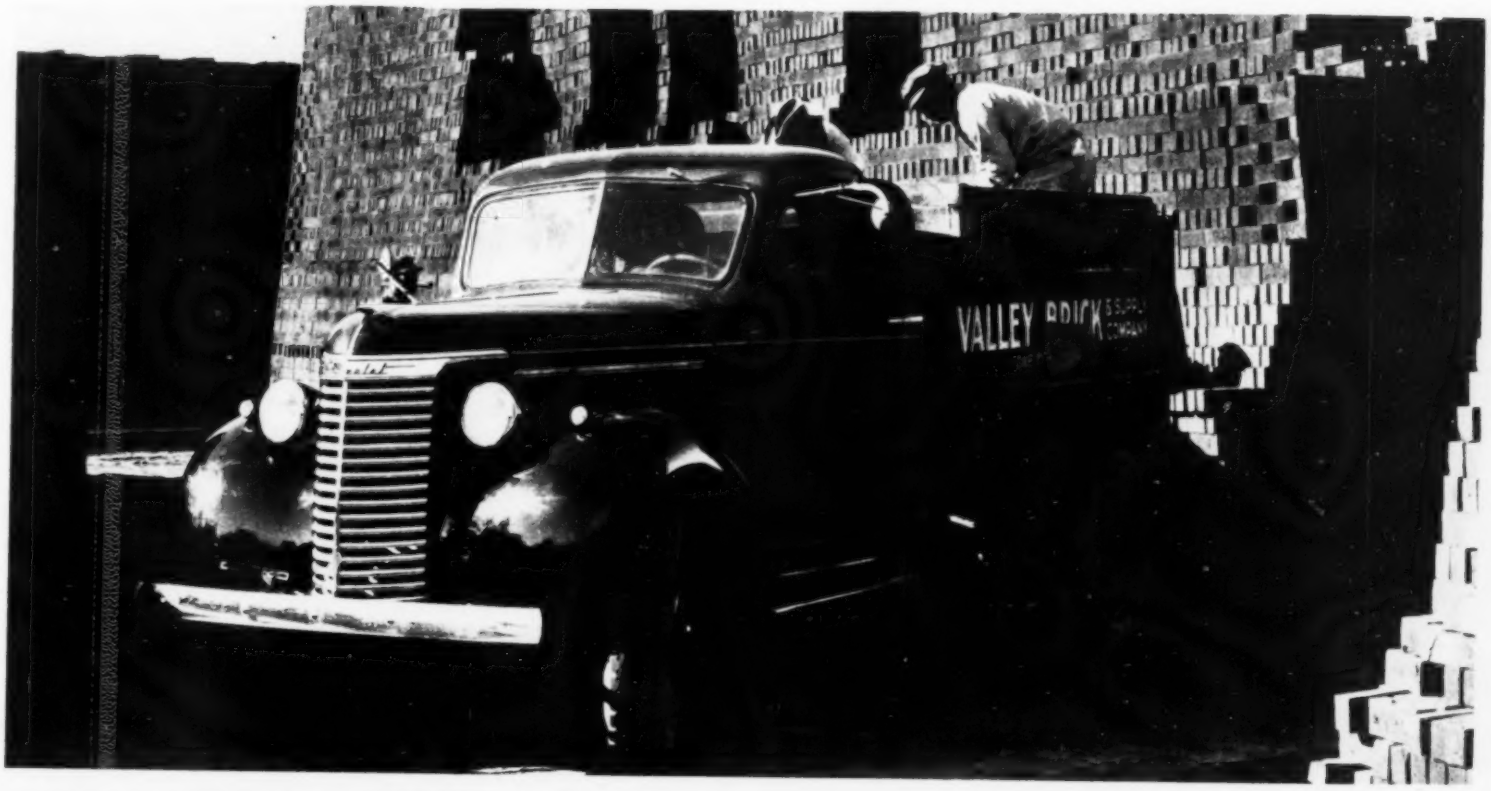
For setting the grade pins, the engineers have developed a simple and rapid procedure. Another photograph illustrates the engineers' method.

To roll the two courses of asphaltic concrete, the contractor operates five Buffalo-Springfield gasoline-power rollers: four 7-ton tandems and one three-axle tandem weighing about 13 tons. The three-axle roller is an ordinary 10-ton tandem with a rear wheel attachment which can be removed. By putting a collar on the king pin of the rear roller, the additional weight of the attachment is thrown on the intermediate wheel for rolling bumps and high places.

Longitudinal joints between lanes of each

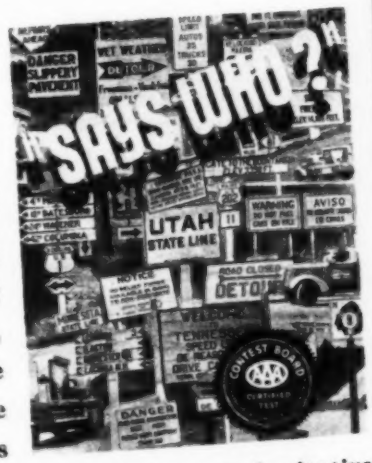
(Continued on page 88)

NATIONAL 1ST LEADER
. . . by popular vote



CHEVROLET TRUCKS
. . for 1940

Get your copy of Certified Facts about CHEVROLET'S PROVED ECONOMY



Ask your Chevrolet dealer, or write to us, for your copy of "Says Who?"—a 16-page book that gives the facts about truck operating costs, facts certified by the Contest Board of the A.A.A. We printed this booklet for *you*—so that you might have authoritative evidence as proof of what Chevrolet trucks can do, and what they cost to operate and maintain.

For the 6th time in the last 8 years, the nation's truck buyers, by their orders, have awarded to Chevrolet first place in truck sales.

Official 1940 registrations tell the story. The latest figures (for the first five months) show 84,167 Chevrolet truck registrations. That is 15,196 more than for the make in second position, and 53,163 more than for the third place make. Incidentally, it's a gain of 10,042 units for Chevrolet over the corresponding figures for 1939.

Chevrolet is the leader in sales because truck buyers are *wise* buyers—because they chose the truck that leads in earning power, in reliability, in value.

CHEVROLET MOTOR DIVISION, *General Motors Sales Corporation*
DETROIT, MICHIGAN

THERE'S NOTHING LIKE EXPERIENCE

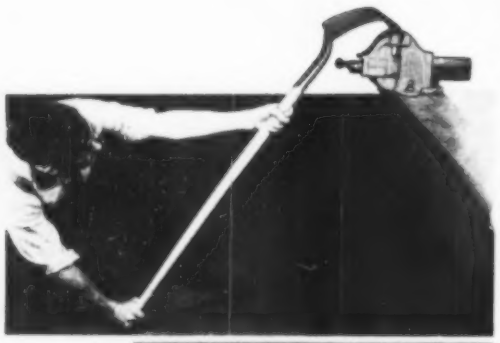
Testing ABW Shovels



• "Of all the many tests to which we subject ABW Shovels, none is more interesting than the blade tests shown here. When you can take a shovel and bend the blade like a hairpin, without the steel showing any fracture or impairment of texture, then you can be sure you have the best in shovel steel. And every day we put hundreds of shovels, selected at random, through this test.

"Every year we break up thousands of shovel handles testing the grain of Northern Ash. From our experience with these tests we have been able to constantly improve the quality of ABW Shovels — and that's why after One Hundred and Sixty-three years ABW Shovels are still the leaders."

Yes, and you can sell with confidence, for your customers will always find Quality, with its assurance of longer service, in ABW Shovels.



The flexibility and toughness of the steel used in ABW Shovels is due to the Continuous Rolling process, a special method of making steel

Not a sign of a break or fracture! ABW blades withstand grueling tests, abuse and tough usage.



SINCE 1774

ABW

AMES BALDWIN WYOMING CO.

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SHOVELS . . . SPADES . . . SCOOPS . . . FORKS . . . HOES

RAKES . . . POST HOLE DIGGERS . . . AGRICULTURAL HANDLES

(Continued from page 86)

course are effectively closed by rolling each freshly placed lane only to within about 12 in. of the edge, leaving this width of uncompacted material to be rolled into the joint in conjunction with the loose material of the adjacent lane, after the latter has been placed.

Runways have a roof crown pitched on a straight 1 per cent grade both ways from the center line. At runway intersections,



TIED TO BLACK TOP PAVER with manila rope, truck is prevented from drifting ahead while load is being dumped. Such drifting prompts braking by truck driver, putting undue tractive load on drive wheels, which tend to tear up prime on base.

the black top pavers carry longitudinal lanes up to a junction with the intersecting crest, leaving a triangle at each junction to be filled by hand prior to rolling. This construction produces satisfactory intersection joints.

Night Lighting — For night work on paving, the Corps of Engineers provides ten portable light towers, with a Kohler gasoline-electric 2,000-w. generating plant and four S&M 500-w. floodlamps on each tower. The towers are mounted on old automobile wheels with pneumatic tires for easy movement.

Administration

Members of the Interdepartmental Engineering Commission responsible for the Washington National Airport were listed in last month's article on base stabilization. H. H. Houk is resident engineer on the project for the Civil Aeronautics Authority, to which was delegated the primary responsibility for design and construction of runways and aeronautical facilities. Maj. J. B. Newman, Jr., Corps of Engineers, U. S. Army, who was officer in charge of all construction at the airport during hydraulic fill operations, has resumed this position after a leave of absence. E. J. Merrick is chief of the engineering division, U. S. Engineers, for the project, and B. J. Bell is paving engineer.

Experiments, tests and inspection of materials and completed work in the stabilized base and pavement of the runways are carried out by the Public Roads Administration, which has its main physical research laboratory and other facilities located on the airport site. E. L. Tarwater

(Continued on page 90)

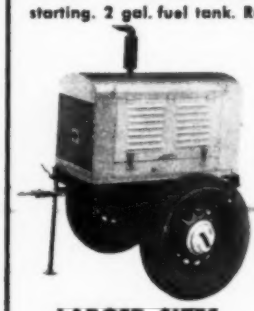
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For Construction Work



1250 WATT PORTABLE

A made-to-order plant for construction work. Two sizes: 1250 watts and 2500 watts. For operating tools or flood lighting. Lightweight, compact, and equipped with carriers for easy portability. Air-cooled, 4 cycle, quick starting. 2 gal. fuel tank. Ruggedly built for hard usage.



WORLD'S MOST COMPLETE LINE

We are builders of the world's most complete line of Electric Plants. In all parts of the world, U.S. plants have proved their steadfast. dependability. And the reason: "U.S." generating sets are designed to meet the conditions under which they will operate.

LARGER SIZES

Larger sizes are available. Illustration to the right is 5KW, 4 cylinder portable unit mounted on trailer with weather-proof hood. U. S. line includes models up to 75 KW. AC, DC, all types of controls and voltages. Write for complete information.

DIESELS

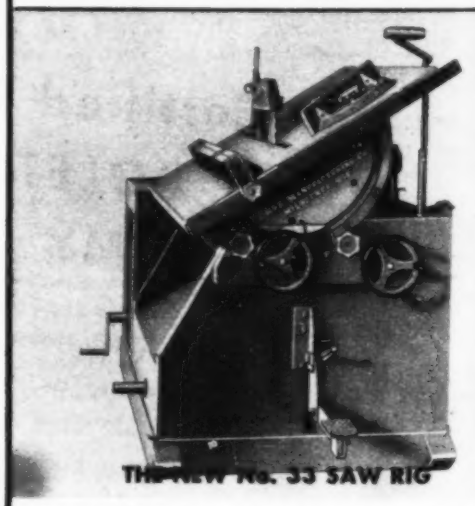
For continuous, heavy-duty service at low cost. U.S. Diesel Electric Plants offer a complete range of sizes from 3 KW to 75 KW—1, 2, 4 and 6 cylinder models.

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C.H.&E.

PORTABLE SAW RIGS



THE NEW No. 33 SAW RIG

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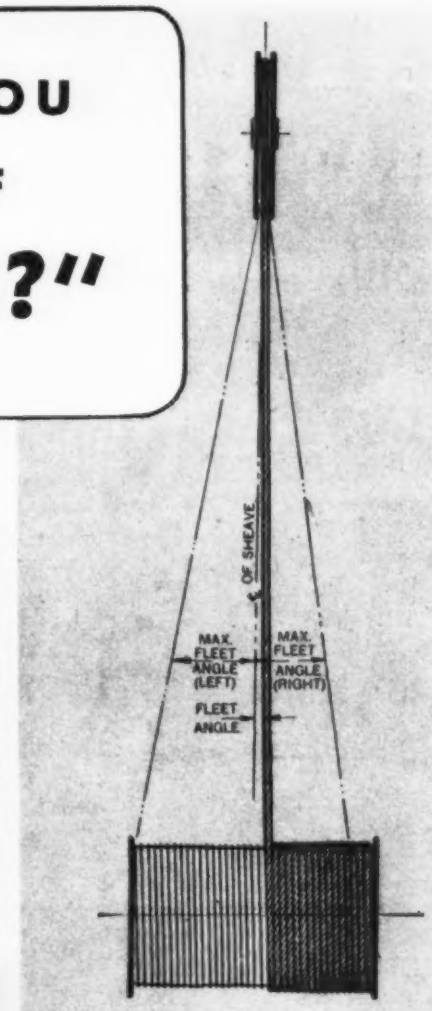
A COMPLETE LINE OF PUMPS — HOISTS — MORTAR MIXERS — SMALL ROLLERS — BAR CUTTERS & BENDERS

C. H. & E. MANUFACTURING CO.

3847 N. Palmer St., Milwaukee, Wis.

"MR. OTT, HAVE YOU EVER HEARD OF FLEET ANGLE?"





EXCELLAY *Preformed* **WIRE ROPE**

IMPROPER fleet angles cause wire rope to rub against the flange of the lead sheave and to side-swipe and pinch against adjacent rope winds on the drum. Experience has proved that you get most satisfactory service when maximum fleet angle is not more than 1½ degrees. That is equivalent to forty feet of lead for every foot of transverse travel to either side of the sheave centerline.

Be sure that all sheaves and drums are properly aligned. Otherwise, excessive flange and rope wear are certain to result. Another common cause of premature rope failure is reverse bending. Wherever possible, avoid reverse bends. If the equipment cannot be altered to eliminate them, use sheaves of the largest possible diameter to ease the severity of bending.

Don't let these faults in reeving rob you of the performance that is built into high-quality wire rope. Correct them now, and you'll begin at once to get the benefits of longer rope life and better all-round performance. Ask an American Tiger Brand Wire Rope Engineer to go over your equipment and make recommendations.

FROM THE DAILY REPORT
OF A TIGER BRAND
WIRE ROPE ENGINEER

Mr. Ott was burned up. "What kind of rope do you call that--practically new and yet it's all chewed up!"

It wasn't hard to see the trouble. The drum was too close to the lead sheave. When reeving on the ends of the drum, the rope rubbed hard against the sheave flanges. So I said to him, "Mr. Ott, have you ever heard of fleet angle?"

"Sure," he said, "but what's that got to do with me?"

"Everything," I said. "That's the whole trouble. Either use a drum with shorter travel, or move the lead sheave up so the maximum fleet angle will be 1½ degrees. I'll lay you two to one that'll step up your rope life at least 50 per cent.

Yours,

al

AMERICAN STEEL & WIRE COMPANY
Cleveland, Chicago and New York

COLUMBIA STEEL COMPANY
San Francisco

United States Steel Export Company, New York

UNITED STATES STEEL

USE A LINER
THAT FITS
YOUR TUNNEL



Small-diameter tunnels, like this 42-inch sewer job, can be lined faster and at lower cost with ARMCO Light-Duty Plates.

• Why use heavy, bulky liner for small-diameter tunnels when you can save time and money with ARMCO Light-Duty Plates? Their corrugated design provides safe strength free from excessive weight and with less than half the usual depth of plate. Naturally, ARMCO Light-Duty Liner requires less excavation and is easier to install than heavy, bulky types.

Material costs are lower too. You buy only the exact weight of plate needed for the job. In many cases you buy fewer plates because completed rings of ARMCO Tunnel Liner may be spaced to take advantage of self-supporting ground.

Let us show you how you can save real money by using ARMCO Light-Duty Liner Plates on that next small-diameter tunnel. Write for prices and complete information. Armco Drainage Products Association, 5011 Curtis Street, Middletown, Ohio.

ARMCO
LIGHT-DUTY TUNNEL LINER

(Continued from page 88)

is resident engineer in charge of inspection on stabilization and paving of runways, taxiways, roadways, and parkways, as well as of the paving and bridges of the relocated section of the Mt. Vernon Memorial Highway, for which PRA is solely responsible.

Asphaltic concrete pavement is produced and laid by the Warren Bros. Roads Co., contractor, Boston, Mass., under the direction of H. W. Makemson, superintendent, and E. M. Pearson, plant superintendent.

* * *

FLOODLIGHTS FOR *Night Baseball*

(Continued from page 45)

directly on home plate and to give the batter a faultless view of pitched balls, a total of eight floodlights illuminates the alley from pitcher to catcher. The ball is visible anywhere in the field, even should it be swatted to a height of 100 ft. above the topmost tier of lights.

Supporting towers are of structural steel and rise from the grandstand roof. Two towers, located near home plate, carry 60 lights each. One tower at first base, one at third and four in the outfield carry the remaining 588 lights, excluding 20 special high bay units mounted on the grandstand roof. The floodlights, 18 in. in diameter, are constructed of aluminum. Their reflectors are finished by the Alzak process to insure high efficiency reflection and long life. The units have glass covers, are both water and heat resistant and dust tight.

* * *

Wood Panel Forms FOR BUILDING CONCRETE DAMS

(Continued from page 63)

with an 11-ft. boom, the cranes raised, handled and set the panels and were, in turn, lifted from block to block by the dam cableway. A combination form jack and lifting bar was developed to pry the lower panel form from the concrete and lift it clear of the upper panel in one operation, as shown in Fig. 1 and an accompanying photograph.

Aluminum A-Frames

One of the most satisfactory pieces of equipment used in lifting heavy panels is the A-frame. Such a rig was designed



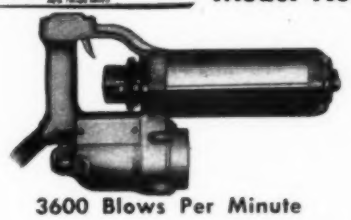
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FOR POWER

DRIVING 36" H-BEAMS *fast!*

• Here's a Union driving 36" H-Beams—and that is no small test of hammer POWER. Union Hammers in their various sizes handle ANY size job, because they're built that way. One-piece frame, no bolts, central-point lubrication—just 3 of many reasons. For steam or compressed air, no change of parts. Backed by 30 years experience.

UNION IRON WORKS, INC.
ENGINEERS & MANUFACTURERS
Spotford and Lidgerwood Aves., Elizabeth, N. J.

THE FASTEST MOST POWERFUL
ELECTRIC HAMMER
on the market today
SYNTRON Model No. 25



3600 Blows Per Minute

10 TIMES FASTER THAN BY HAND
for drilling up to 2" Holes in Concrete — Cutting and Chipping

•

Send for your copy of our latest Electric Tool Catalog No. 300.

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SYNTRON CO.
500 Lexington Ave. Homer City, Pa.

fabricated for handling 12-ft.-high single-course forms at Chickamauga. Constructed of aluminum alloy members, with an overall height of about 14 ft. 1 in., the Chickamauga A-frame mounted a 61-lb. 3-ton-capacity Coffing roller chain hoist. The entire A-frame unit weighed only 212 lb., and it was easily handled by the form strippers in the blocks without waiting for mechanical handling equipment. The weight of a 2-in. pipe brace, placed at the rear of the A-frame was additional.

When the weight of a form panel exceeded the capacity of one A-frame, it was a simple matter to operate two or more simultaneously to lift the form. These A-frames, constructed for about $186 per unit, including the Coffing hoist, were cheap enough to justify owning a sufficient number to eliminate the necessity of moving them from one end of the job to the other. Photographs illustrate the use and operation of the A-frames at Chickamauga.

When set in position, the A-frame was supported from the rear by a pipe made of heavy material and designed in two telescoping sections, with an upper section fitting inside a lower section connected to an anchor bolt embedded in the concrete. Holes spaced on 2-in. centers in the telescoping portions of the pipe made it possible to adjust the length of the leg.

Roller chain hoists of the ratchet lever type, operated by pumping extension rods attached to the handles, were reversible, enabling panels to be raised or lowered. Each jack had a line speed of 2 ft. per minute, and the panel could be raised 10 ft. in 10 min. This type of A-frame was used also for lifting forms at the Chickamauga lock, where the entire length of a 50-ft. block was raised to position by simultaneous use of five A-frames.

A similar A-frame was designed for 3,600-lb. load for lifting the 7-ft.-high Hiwassee dam panels (Fig. 2). This frame was about 9 ft. 9 in. in height and weighed approximately 98 lb. The hoist weighed an additional 45 lb., making a total of 143 lb. Several improvements were made, including a screw foot on one of the legs to permit ready adjustment to overcome differences in the rough surface of the concrete. Details of construction of the Hiwassee A-frames are shown in Fig. 3.

Handling by Cranes

Required horizontal moves of panels, as in the construction of reservoir walls, prohibit the use of light, simple A-frames, and a piece of equipment with good mobility and sufficient boom capacity is necessary. The most commonly used equipment for this purpose is the crawler crane. A serious objection to the use of the mobile crane for moving panels is that the form crew ties up this comparatively expensive piece of equipment for a considerable period while installing proper bracing; furthermore, the panels after being stripped must be stored on the ground until a carpenter crew is available. Storing the forms on the ground introduces another objection in that it

(Continued on page 92)



● Few tools have gained the universal acceptance anywhere that Williams' Structural Wrenches enjoy among steel workers. These tough, dependable, well-designed tools are practically standard equipment on every steel erection job.

The large wrench illustrated above is the popular-priced Williams' "Superior"—forged from specially-processed carbon steel—approximately the same strength as a corresponding alloy steel pattern (also made by Williams). The same pattern is available in Williams' "Superrench" line—forged from chrome-molybdenum steel—at higher price. Structural "Superrenches" are also available with a box head and 12-pt. opening, instead of the conventional open-end pattern.

Write for Williams' booklet "How To Select and Use Wrenches". Williams' Wrenches are sold by industrial distributors everywhere.



Now in National Defense . . . . .

TIME IS THE MOST IMPORTANT FACTOR . . . .

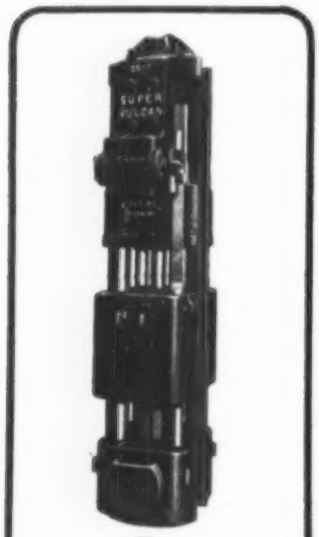
So—do those Pile Driving Jobs faster with an Open Type

SUPER-VULCAN

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Sizes
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meet all needs

★ Dependable performance—speed—economy for those faced with rush construction such as docks, industrial buildings, bridges. A contractor from Arizona writes that the Super-Vulcan is "built right for the work." Others make similar statements. Its great value is proved time and time again. Write today and let us give you all the facts so important to you—see how you can benefit in time and money savings with Vulcan Pile Driving Machinery.

VULCAN IRON WORKS Since 1852

331 North Bell Avenue

Chicago Illinois

(Continued from page 91)

leads to the likelihood of interchanging panels from block to block, materially increasing the transporting and handling costs. When panels are raised from ground storage to their new position, interchanged panels will have anchors and ties that do not match those previously used. Further, if a crane is serving two or more carpenter gangs, it is not always immediately available for each crew's requirements, and it thus causes delays for the entire gang.

A structure such as a high navigation lock, combining a large number of horizontal and vertical handlings, can use to advantage both A-frames and a mobile crane for handling the forms.

Field Labor

Labor time studies disclose a number of surprising practices being followed by intelligent and experienced craftsmen through force of habit, through taking the line of least resistance or through common carelessness. Repeated time studies invariably reveal that, although action by the superintendent eliminates some of the malpractices and reduces the effect of others, there is good reason for frequently checking the methods of work of such continuous and costly nature.

In general, inefficient practices are similar on all jobs. If a constructor will check the following items on his job, the chances are ten to one that he will find some that need correcting. These habits are costly and, as they are not necessary, they come out of the profits. There is little chance of catching many common malpractices unless a definite, planned effort is made to study field construction. It is often amazing to discover the "leaks" that need plugging and to learn the seriousness of leaks that were, prior to study and analysis, regarded as insignificant. Such planned investigations are usually carried on by means of time studies. If wisely chosen, planned and used, time studies cost only a small fraction of the savings which they enable the superintendent to make.

Time studies ordinarily should not be made on short jobs unless their costs appear justified to obtain certain data for future reference. It should be noted, however, that a one-day time study of a drilling operation gave highly beneficial results on a small job where the excavating program extended over a period of only one week.

With the report of field time study findings, valuable ideas can sometimes be obtained from the men who have made the study. These possibilities are illustrated in an abstract of a formwork time study presented. The following tabulation lists nine practices (a) resulting in high costs and recommended procedures (b) to correct them.

1. (a) Careless placement of anchor bolts
   (b) Use of templet and level enforced
2. (a) Splitting up of crews
   (b) Small floating crew established to take care of odd jobs

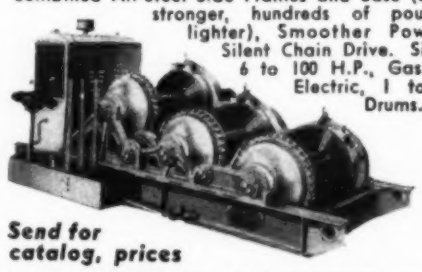
(Continued on page 94)



JAEGER Builds the MODERN HOIST

- FINGER-TIP CONTROL of Loads up to 100 H.P. thru Giant Expanding Frictions or Clutches.
- ANTI-FRICTION BEARINGS, replacing babbitt or bushings, on all heavy duty models.

Combined All-Steel Side Frames and Base (50% stronger, hundreds of pounds lighter), Smoother Power, Silent Chain Drive. Sizes 6 to 100 H.P., Gas or Electric, 1 to 3 Drums.



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ASPHALT PLANTS

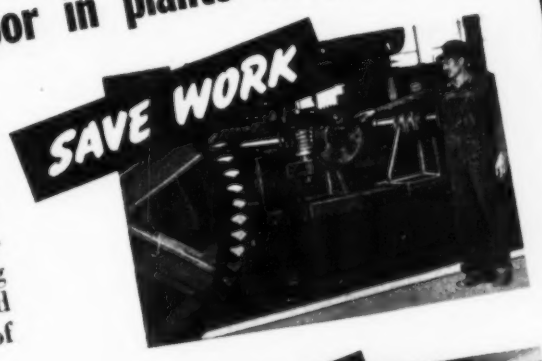
- Portable Combination Hot and Cold Mix Plants
- Portable Hot Mix Plants
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- Steam Jacketed Mixers 400 to 8000 pounds capacity.
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PROVED TO SAVE!

How Lubriplate Lubricants are cutting costs, saving time and labor in plants everywhere



The superintendent of a large Birmingham, Ala. concern* manufacturing heavy duty machinery writes, "In July we tried Lubriplate 130-A on the worm and wheel indexing mechanism of a 24" gear cutting machine. There was such a remarkable reduction in the friction we have been using Lubriplate on all gearing and heavy bearings and are now recommending it to our purchasers of large gears and other machinery."



In the plant of a prominent manufacturer* of asbestos products located in Bridgeport, Conn., it was necessary to repair or entirely replace the joints in a 600 ton toggle press every four to six months. This concern writes, "The use of Lubriplate No. 305 on these heavy duty toggle joints began over a year and a half ago and it looks as if they will run indefinitely."



World's largest construction job—Grand Coulee Dam. An unsolicited report states, "Lubriplate certainly solved the heat and dirt situation besides saving 75 pounds of grease per machine per week. Where we had used four kinds of grease, we used but two Lubriplate products—Nos. 110 and 130-A. Bearings cooled down and wear reduced to ⅓ of what we had become accustomed to expect."

* Name on request.

Lubriplate Division of the
FISKE BROTHERS REFINING CO.
NEWARK, N. J. TOLEDO, OHIO

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Lubriplate meets today's heavy duty service requirements because it is different from ordinary lubricants. It "stays put" and lasts *longer*. What's more, Lubriplate is extra resistant to rust and corrosion. Write—we'll see that you receive enough Lubriplate for a thorough test.

Dealers from Coast to Coast

LUBRIPLATE

THE WHITE LUBRICANT THAT MINIMIZES WEAR

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Dragline buckets for all types of work · Capacities ⅜ to 15 cubic yards

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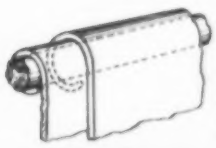
Lightens THE LOAD



FOR concrete work, Sterling Models S-17, S-18 and S-19 are selected by leading Contractors because of these outstanding features:

Perfect Balance — 10-Spoke Wheels
Self-Lubricating Bearings
Welded Trays — Heavy Tray Load
Malleable Wheel Guards
Channel Steel Legs
Square-Bent Leg Shoes
Hard Maple Handles — Interchangeable Parts
Malleable Iron Wheel Brackets

Capacities 3, 3½ and 4 cu. ft. struck.
Complete stocks available from Warehouses and Distributors in principal cities.



An Exclusive Sterling Feature
Where tray sheets lap, both thicknesses are folded over the continuous butt-welded reinforcing rod, thus giving additional rigidity and strength.

MOST OF THE LOAD IS CARRIED ON THE WHEEL

Sterling Models S-17, S-18 and S-19 are also used for general purpose work, handling sand, gravel, brick, etc. In this service, they have a maximum capacity of 4, 4½ and 5 cubic feet, respectively.

STERLING WHEELBARROW COMPANY

MILWAUKEE, WISCONSIN

(Continued from page 92)

3. (a) No materials in block at beginning of shift
   (b) Materials needs anticipated in each block
4. (a) Damage to, and loss of, materials by cleanup crews
   (b) Use of platform on block to stack excess materials
5. (a) Carpenters unaided by helpers
   (b) Attention to 3(b) would remedy this situation, caused by lack of materials
6. (a) Crew congestion in block
   (b) Coordination of work in block
7. (a) Poor lighting conditions
   (b) More lights—better arrangement of lights
8. (a) Skilled labor doing unskilled work
   (b) Proper planning of work
9. (a) Sleeve bolts hard to remove
   (b) Thorough greasing of sleeve bolts and tierods

Carelessness Costs Money

Faulty practices cause a pyramiding of costs, as the following notes demonstrate. Simple changes in practice can correct the troubles in their entirety.

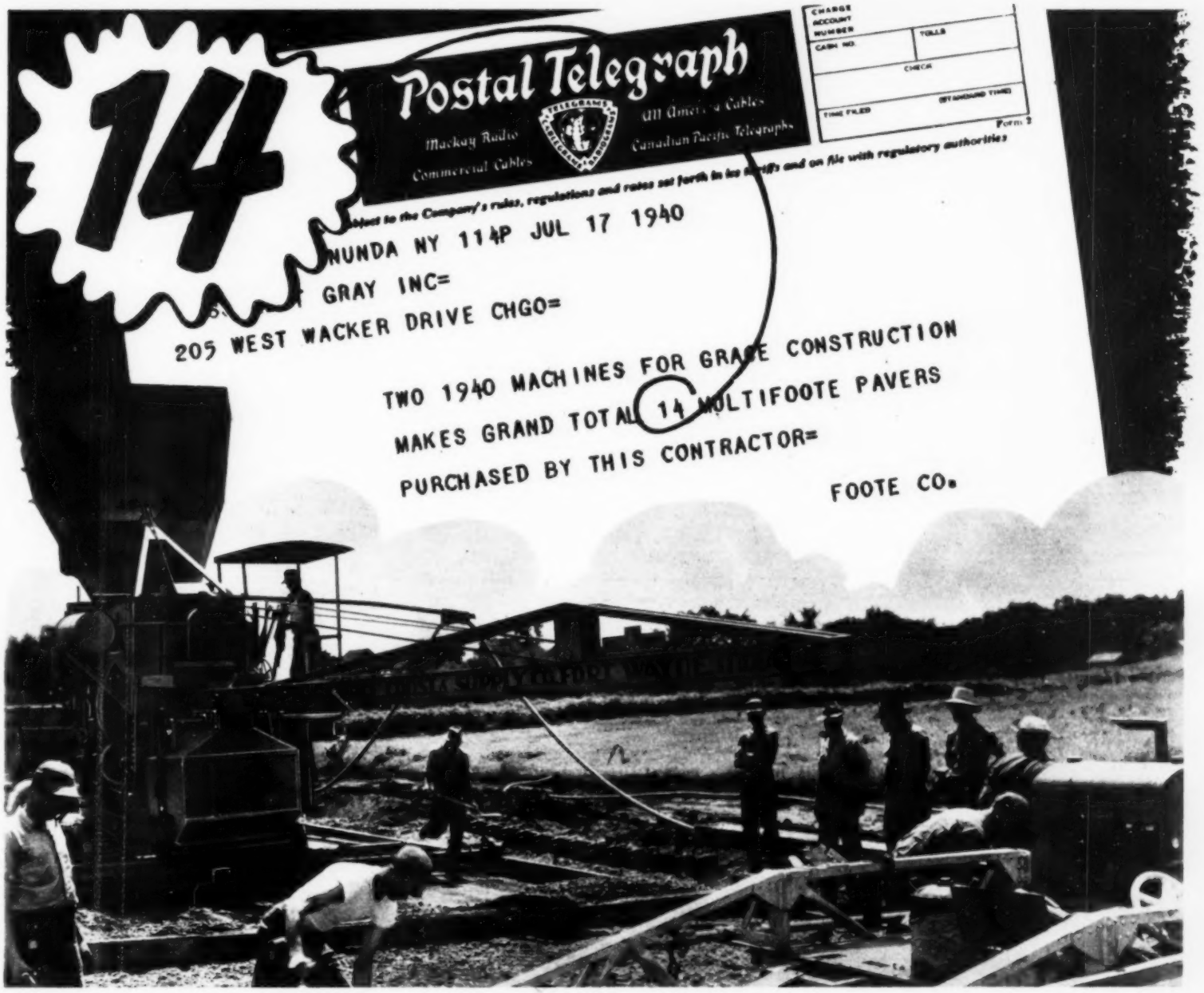
(1) *Laxity in the setting of anchor bolts.* If the anchor bolts are not set correctly as to alignment, angle, and amount of bolt protruding above the concrete, the following difficulties will result: (a) Anchors do not match holes in panels; (b) bending to make them fit may cause wedging action which slows down or makes impossible the sleeve bolt removal; (c) if bending does not suffice, new holes must be bored in panel and through wale; (d) in this latter case, wale has to be notched and beveled to seat the washer and nut; (e) if anchor is set too far back from face of block, the tierod falls short and has to be extended by addition of extra sleeve nut and short piece of threaded rod sawed off from stock; (f) if wedging action makes removal of sleeve bolt impossible, panel must be pulled off over it. In this event, panel is damaged, and lagging has to be repaired. In addition, concrete around bolt has to be chipped out to depth of 3 to 5 in., and the bolt then has to be burned off and the hole patched.

(2) *Erection crews show no interest in stripping cost.* If care is taken in erection, stripping cost can be materially reduced. Carelessness in erection causes difficulties. Perhaps not enough grease is used. Burred sleeve bolts which could be repaired in a moment with a file may be installed and later have to be removed at excess cost, or the panel may have to be pulled off over them. A small burr at the tapered end of the sleeve bolt can and does make the bolt impossible to remove. These difficulties should be avoided. Lag screw threads are less likely to burr than ordinary threaded bolts.

(3) *Dip all universal bolts* in oil before screwing on to rod, and grease outside just before concrete is poured.

(4) *Material requirements,* chiefly lumber and hardware, should be anticipated and supplied to points of work at the prop-

(Continued on page 96)



And, for Black Top

...The Adnun Black Top Paver brings you Continuous Course Correction, the exclusive Adnun feature that means smoother pavements.

The Adnun overlapping cutter bar with its bevel tooth design exerts a pressure that gives a compact course without bringing fats to the top or tearing the pavement—particularly important in handling cold mixes.

If you are figuring on putting down Black Top or *rock*, be sure to see the Adnun and don't forget Adnuns for *Airport Work*.

27E

14 MACHINES—*13 repeat orders* for MultiFoote Pavers by Grace Construction & Supply Co., Fort Wayne, Indiana! That's a real record of satisfaction—of years of profitable paving—of proof of MultiFoote superiority. Grace Construction knows that these pavers button down jobs on schedule, make contracts pay out.

And there was no misplaced confidence when this contractor put two new 1940 machines to work. These better-than-ever MultiFootes are making outstanding records for speed—records made possible by a host of new advantages: Improved crawler mechanism—fully enclosed travel transmission running in oil—longer, stronger crawlers—long boom—wider, stronger, faster skip—heavier, powerfully braced frame—all this added to standard MultiFoote features—double cone drum—¼ turn discharge—high operating platform for better vision—simple accurate water system—Timken Bearings—power take-off has helical cut gears running in oil—extreme simplicity—easy to get at mechanisms.

Take advantage of the speed, endurance and profit abilities of the MultiFoote. Don't buy a paver until you have the whole story. A new catalog is available. Write today for your copy!

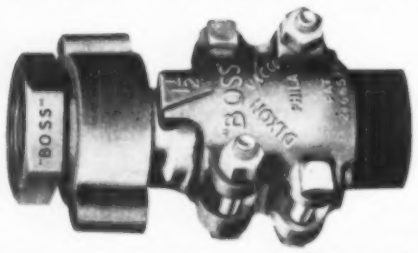
THE FOOTE CO., INC., Nunda, New York

1940 MULTIFOOTE *Better than ever*



This unique jetting rig, setting the pace for the concrete gang, is driving 160 to 175 fluted steel piles per hour. To insure steady, trouble-free operation, feed hose and short hose connections are made with dependable

"BOSS" COUPLINGS



"BOSS" FEMALE COUPLING
WASHER TYPE, STYLE W-16

When hose lines in any type of service are connected with "BOSS" Couplings, the possibility of leaks, pressure losses and blow-offs is virtually eliminated. What's more, the life of the hose is materially increased, because "BOSS" Couplings actually protect it where it is generally first to "go"—the ends. All parts are steel or malleable iron, cadmium plated. Sizes: ¼" to 4", inclusive, with strong 4-bolt "BOSS" Offset-Interlocking Clamp on 1" and larger. Sizes ⅞" and smaller have 2-bolt clamp.



"BOSS" MALE COUPLING
STYLE MX-16

The companion coupling for the "BOSS" Female Coupling described above, and for the ground joint, washerless type, "GJ-BOSS" Style X-34. Used in place of iron pipe nipples, it is much more practical and economical, as it eliminates the need of over-size hose. Cadmium plated—rustproof. Sizes ¼" to 4" inclusive, with 4-bolt "BOSS" Offset Interlocking Clamp on 1" and larger; 2-bolt clamp on ⅞" and smaller.

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(Continued from page 94)

er time and in proper quantities. Otherwise, the carpenter helpers of each crew must spend their time touring the job in quest of materials needed to carry on the work.

(5) *If a crane is used* for erecting and stripping panels, insufficient coordination of crane requirements will contribute to high costs. The efficiency of the carpenter crews is ever at the mercy of the availability of crane service.

(6) *Panel repair costs are likely to be excessive.* Lagging may be torn loose at the top of the panel, as a result of the presence of sleeve bolts which should have been removed. Improper setting of anchor bolts sometimes may make sleeve bolt removal impossible. Panels should never be handled carelessly by a crane operator.

(7) *Crew work should not be interrupted* for miscellaneous odd jobs. Crews are broken up and their production efficiency impaired when carpenters are called out of a block to other points on the dam to build walkways, to work with electricians or pipefitters, or to complete work on forms left by other crews or other shifts. As there is always a certain amount of miscellaneous work to do, a floating gang of the proper size should be organized to take care of it, leaving other regular crews free to work without costly interruption.

(8) *Carpenter crews* should not report at a block only to find no panels, no lumber, no hardware, no crane and no preliminary cleaning of concrete from the previous pour.

(9) *Skilled labor* should not be used in work requiring only unskilled labor.

(10) *Insufficient lighting* increases the difficulty of locating the points of alignment, lowers efficiency and causes eye-strain.

(11) *Cleanup crews should be impressed* with the value of salvageable materials, especially hardware, and suitable means should be provided for storing this material. Pockets built on the backs of the panels make convenient places to store excess small pieces of hardware and nails. This provision also eliminates extra handling of these supplies when raising or moving the forms from block to block.

(12) *Electric or air drills* should be used in preference to hand drills wherever possible, except in isolated work. Holes should be larger than the rods they accommodate to facilitate aligning operations and prevent binding during stripping operations.

(13) *Cleaning of panels* should follow cleanup in the block. For effective results a coating of oil should be applied to the panels just prior to concreting.

(14) *Tapered sleeve bolts* are more readily loosened and removed than straight shank bolts.

(15) *Use of a templet* to obtain accuracy when placing form tie anchors in the fresh concrete results in appreciable economy when setting and aligning forms.

(16) *Repetition of aligning or other work* as a result of changing shifts should be avoided through proper coordination by the various foremen.

(17) *Safety scaffolds* on panels large-

2 Mall PORTABLE POWER TOOLS THAT ARE MAKING MONEY FOR CONTRACTORS EVERYWHERE!

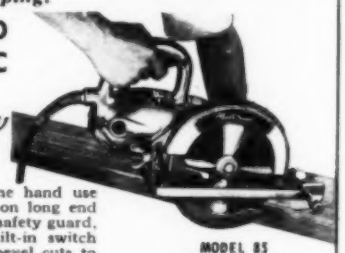


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ly eliminate personal danger during erection and stripping operations and thereby reduce costs.

Shop Construction

Wood panel forms in general are most economically constructed in properly equipped carpenter shops where protection from the weather, clear working space, air, power saws, small tools and other facilities are provided. In such a shop can be assembled craftsmen who are qualified by training, experience and ability to lay out and construct simple or complicated forms in mass quantities. When a large number of panels is to be constructed, mass production is accomplished in much the same manner that an automobile is put together on the assembly line, and the process can result just as surely in economy of construction. On a large, modern construction job a carpenter shop is thoroughly planned both for service and for convenience. The choice of its location deserves consideration equal to that given to the locations of the warehouse and machine shop.

Carpenter Shop — A carpenter shop warrants only the cheapest construction as, after all, it is only a temporary structure built to protect the equipment and the workers from the elements. Shop construction often employs galvanized corrugated metal walls and roof, with a sturdily built supported plank floor. Floor area should be sufficient to provide ample working space around equipment and extra room for temporary storage of partially completed work. Such a shop building inclosing 3,000 to 5,000 sq.ft. of inside floor area can be constructed for from $1 to $1.50 per square foot, to which must be added the cost of the various rip and cutoff saws, planers, joiners, band saws and other equipment. The shop should be provided with air, water and electric power. It is advisable to construct an open platform for auxiliary working space in fair weather. This platform should generally have an area equal to, or greater than, the inclosed shop.

Heavy Load Handling Equipment

It is necessary to provide equipment for handling and loading heavy forms. A number of methods may be utilized, among which are the following:

(1) MOBILE CRANE. Use of a moveable crane may be objected to on the ground of economy unless there is sufficient necessary work around the shop yard to keep the machine constantly busy. In general, however, the crane has considerable waiting time which makes it too costly.

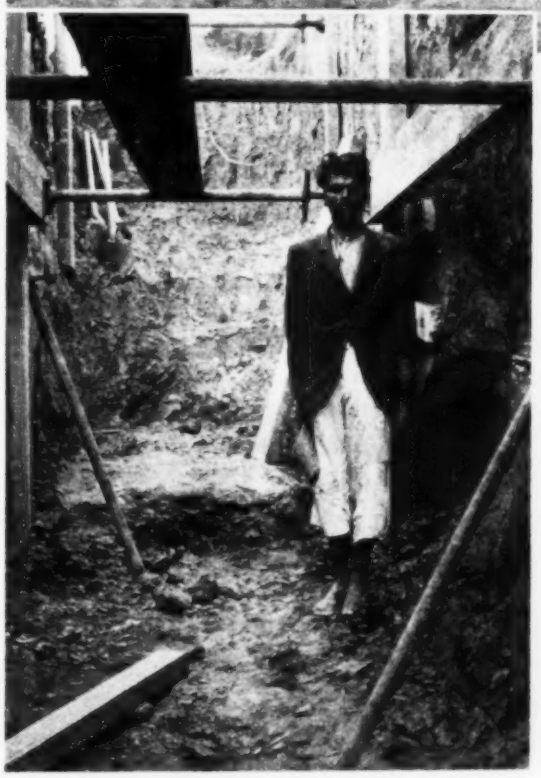
(2) STATIONARY CRANE. A stiff-leg or guy derrick erected on or adjacent to the platform and equipped with a boom of sufficient reach to handle and load the heavy forms on the platform is an economical piece of equipment that pays for its investment many times over. It can be operated with a hand winch or by an air, gas or electric hoist. In any event it should be so set up that the men requiring its use can operate it. Otherwise, the expense of maintaining an operator proves costly. At Chickamauga dam, A-

(Continued on page 98)

Moretrench in Iran . . .



● The excavator paddled around on sheet iron mats.



● At the bottom of this dried up, skeleton-sheeted trench a young Iranian poses with quiet dignity — unbooted and unafraid.

A planned city in Iran (formerly Persia) was located on quicksand of unknown depth and fine enough to pass a 200 mesh screen.

Sewerage facilities had to be built first. A MORETRENCH WELLPOINT SYSTEM, ordered through our London agents, Blaw-Knox, Ltd., and installed under the personal supervision of a Moretrench engineer, dewatered the quicksand to a point below subgrade so that work could go ahead with speed and economy — IN THE DRY.

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You, too, will find Williams digging speed and durability a big factor in producing profits. Tell us the type of service you are interested in and we will send free, individual bulletins giving complete information.

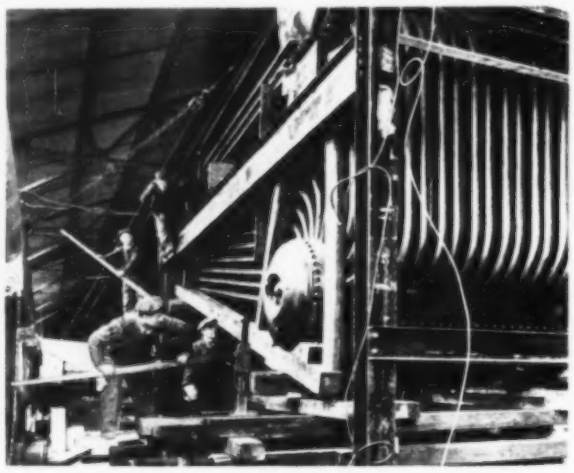
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WILLIAMS *Buckets*
***built by* WELLMAN**





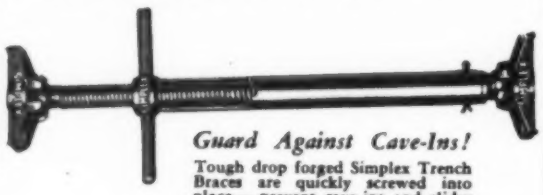
Simplex No. 29 15-ton jack makes easy work of a foundation job for this Michigan contractor. Dozens of jobs took less time in this mid-west industrial plant project because of the No. 2029 20-ton Simplex Jacks shown placing a boiler.

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Using Simplex Jacks on every lifting, lowering, moving and pushing job saves for contractors. One man and a Simplex Jack can do jobs that would otherwise require three, four or more men.

Every Simplex Automatic Lifting and Lowering Jack is guaranteed to lift and hold its full rated capacity on cap lift or toe lift of jack. The Simplex "Gold Medal Award for Safety" ratchet mechanism protects workmen, provides ease of operation and years of dependable service. Ask your supply house about Simplex Jacks—there are dozens of types in every needed size for every construction and engineering requirement.

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SIMPLEX Jacks

Awarded the Gold Medal for Safety



(Continued from page 97)

frames were used to load heavy panels on trucks.

(3) TRAVELING OVERHEAD-TRACK CRANE. An excellent example of the use of a traveling crane was the system installed at Hiwassee dam and illustrated by an accompanying photograph. The installation consisted of a steel I-beam track supported by timber columns, upon which ran two P&H 5-ton electric trolley hoists.

NEXT MONTH: **— In the September issue, Part IV of this series of articles on Wood Panel Forms will discuss the planning and making of time studies and the use of time-study reports.**

★ ★ ★

Armory Has Huge Wood Lamella Roof

(Continued from page 39)

and Marine Corps Reserve.

The Lamella roof consists of a series of skew arches which make up the pattern and offer a comprehensive and economical method of resisting the stresses produced by the action of vertical and lateral loads. The basis of design is the two-hinged arch, the thrust at the base of the Lamella being delivered to a concrete wall and balcony approximately 12 ft. above the main floor of the drill deck. These cantilevered walls are tied at the floor line with reinforced concrete ties.

The true Lamella span is 122 ft. 4½ in., the rise, 35 ft. 1¼ in., and the length 254 ft. The Lamellas consist of a 3x16-in. timber 16 ft. long, cut radially to a radius of 70 ft. 10½ in. and milled and bolted to form the familiar diamond pattern.

Tongue-and-groove sheathing of 2-ft. width was used for the roof covering. This heavy sheathing, together with the heavy Lamella construction, produces a structure of great fire resistant qualities, as well as one capable of standing up against earthquake and wind forces.

A second unit of the armory, separate from the drill shed, is the main administrative building of reinforced concrete construction, three stories high with a mezzanine floor and tower. This building, 300x140 ft. has a floor area of 122,000 sq.ft. with an additional 40,000 sq.ft. of space in the basement.

The armory occupies a 4½-acre site and is surrounded with ample grounds for landscaping. A parking area, also available as a parade ground, contains 82,000 sq.ft. entirely inclosed by reinforced concrete retaining walls, the highest of which is 25 ft.

Construction of the armory was made possible through a federal contribution of $724,131, largely for wages for the WPA

(Continued on page 100)

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Hundreds of comparative test results prove that Naturalube possesses a three to ten times stronger film and the ability to remove hard carbon from engine parts. Also, hundreds of service records prove that Naturalube conserves power — saves fuel — and reduces friction wear.

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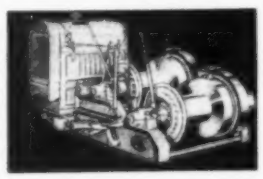
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AND OWEN IS BUILDING THEM

(Continued from page 98)

workers, and a pledge of $364,000 by the sponsor. It is estimated that an additional sponsor's contribution of $100,000 will be necessary to complete the swimming pool and facilities on the third floor.

* * *

Twelve Tunnels FOR SHASTA DAM RAILROAD

(Continued from page 53)

was rimmed out to permit the installation of the wall plates and arch ribs on centers as required to support the ground. The top heading core thus inclosed by the steel supports was removed and the top portion of the full-face was established.

Next the bench section, below wall plate elevation, was excavated and plumb posts were installed beneath the wall plates as this operation progressed. After excavation of the bench was completed, the full-face thus opened up was carried forward in one operation.

A large steel jumbo was constructed for each tunnel to provide access to the full-face during drilling and loading operations. Each jumbo provided three working decks and was equipped with 8 Ingersoll-Rand automatic drifter drills, two on each deck and two at ground level. Drill mountings provided for necessary vertical and horizontal swinging, permitting drilling of holes into the face at any desired angle. An electric hoist arrangement installed at the rear of the jumbo was used to switch cars during mucking operations.

The central air compressor plant was made up of 4 stationary Sullivan, size 16x 9¾x10-in. compressors, each unit supplying 650 c.f.m., and an auxiliary 350 c.f.m. capacity Gardner-Denver unit. The total plant capacity was 2,950 cu. ft. per minute at a pressure of 110 lb. per sq. in. Air was supplied to the tunnel portals in 6-in. lines and was carried into the headings in 4-in. lines. Pressure of 100 lb. per square inch was maintained at the drilling jumbo, which was 3,300 ft. away at the most distant heading.

Drilling Practice — Headings were drilled for 11-ft. rounds and approximately 10 ft. of ground was broken ahead after each blast. The average drilling time for each round was 6½ hr. for from 104 to 120 holes. A daily average of one and one-half rounds per tunnel, or 15 lin. ft. of progress, was maintained throughout the period of excavation. (See Fig. 1 for diagram illustrating position and spacing of holes).

From 400 to 500 lb. of 40 to 60-per cent gelatin dynamite were used for each round of muck, removing from 200 to 250 cu. yd., or about two pounds per cubic yard. Bethlehem 1¼-in. hollow round drill steel

(Continued on page 102)

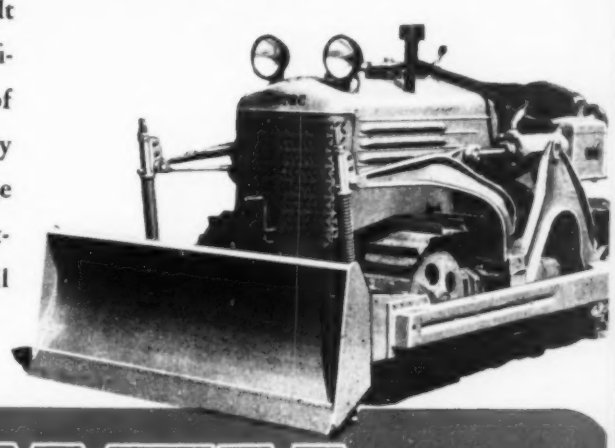
Profit-wise Contractors choose HEIL HYDRAULIC TRAILBUILDERS AND BULLDOZERS!

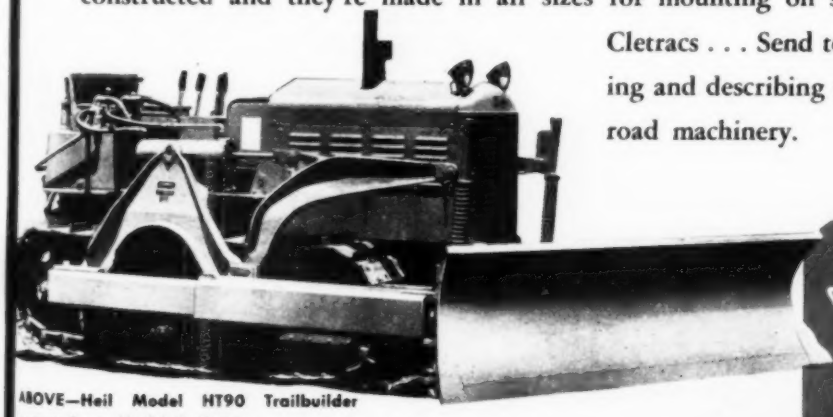
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BELOW—Heil Model HB25 Bulldozer mounted on Model A Cletrac





ABOVE—Heil Model HT90 Trailbuilder mounted on Model F Cletrac

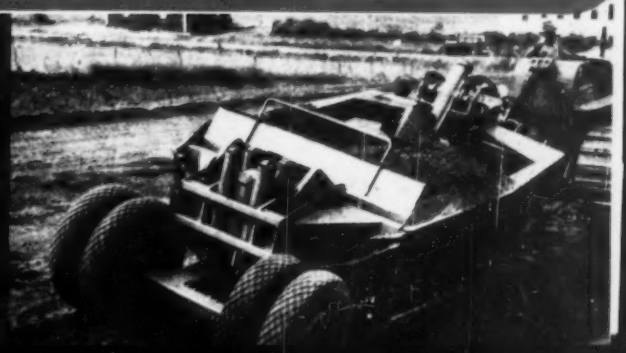
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RIGHT—Heil Hydraulic Scoops have proved their dependability on tough jobs like the Pennsylvania Turnpike. Complete facts and recommendations are yours for the asking.



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District Representatives in Principal Cities

(Continued from page 100)

was used throughout in six different lengths, 3½, 5½, 7 , 9 , 11½, and 13½ ft., respectively. About 500 pieces of steel in varying lengths were required for each heading, or about 1,500 pieces per 24-hr. period.

Steel was sharpened in shops adjacent to the compressor plant. Two Ingersoll-Rand oil furnaces supplied the necessary heat and sharpening was done with two Ingersoll-Rand Type 40 compressed-air sharpeners. Bits were tempered with cold water to obtain necessary hardness and shanks were heated to "lemon yellow" and tempered in oil for about 5 in. of their length. The color of the heated steel was used to gage proper temperature, which was approximately 1,300 deg. F. for bits and approximately 1,200 deg. F. for shanks. Very little breakage of steel was experienced and practically no plugging was encountered, the tunnels being driven in very hard material. Bits for the 3½-ft. starters were dressed on 2¼-in. dollies. Each successive length of steel was dressed with a ⅛-in. smaller bit to a minimum size of 1⅝ in. for the 13½-ft. lengths. Conway mucking machines were used to remove the blasted material from the headings. Each round consisted of about 100 cars of muck or about 250 cu. yd. To muck out the round required 8½ hr., using four and five 2½-cu. yd. capacity Koppel cars and a Westinghouse 6,000-lb. drawbar capacity electric trolley and storage battery locomotive on each train, with two trains per tunnel.

Rock in both tunnels Nos. 1 and 2 was a hard grey quartz diorite or granitic rock which required practically no steel supports except for short sections adjacent to the portals.

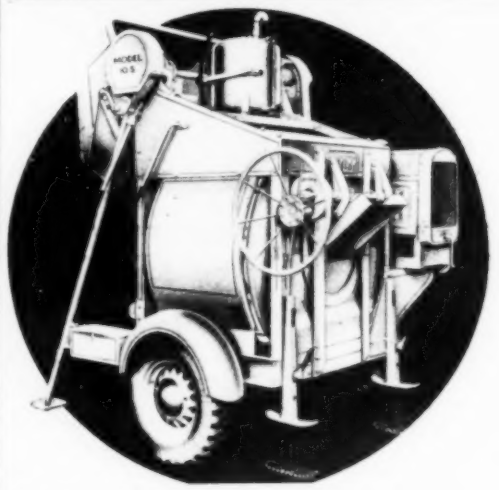
Second Contract—Two Tunnels

The second contract, including the driving of tunnel No. 11, 941 ft. in length, tunnel No. 12, 916 ft. in length, construction of the third and fourth Sacramento River bridge substructures, and some roadbed grading, was awarded to the United Concrete Pipe Corporation and Ralph A. Bell of Los Angeles on a bid of $598,673.50. Tunnels under this contract were driven by the top-heading and bench method. Excavation of the top heading was completed first for the entire length of each tunnel before the bench section was removed. This work was carried on simultaneously in both tunnels, driving the south heading in tunnel No. 11 and the north heading in tunnel No. 12. Tunnels Nos. 11 and 12 were drilled through rock made up of shales, sandstones and conglomerates of the Bragdon formation overlain by ancient river gravels which, in turn, are capped by a basalt lava flow. Because this contractor is also a member of the firm which submitted the low bid on the fourth tunnel contract, and because plant set-ups for both jobs are practically identical, further details of methods and procedure will be described under the fourth tunnel contract.

Third Contract—3 Tunnels

The third contract under which tunnels are being driven extends over approxi-





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mately 4 mi. of the railroad relocation and includes tunnels Nos. 8, 9 and 10 which are 915, 1,610 and 2,235 ft. in length, respectively. The R. G. Clifford Co., of San Francisco submitted the low bid for this work with a price of $1,223,186.40. Rock in these three tunnels is made up largely of graphitic shales with some sandstone and conglomerates intruded by small dacite porphyry dikes. Portions of the rock were weakened considerably by crushing and faulting. At this writing, excavation of tunnel No. 10 has been completed and the top heading excavation has been completed in tunnel No. 9. Work on tunnel No. 8 is in the preliminary stages. The top-heading and bench method of excavation is being used by this contractor.

Top Heading and Bench Method—After stripping the overburden from the portal faces two 5x7-ft. drifts were pioneered at wall-plate elevation, one on each side of the tunnel, to gain access to firm ground. It was necessary to drive these drifts for a distance of about 50 ft. before firm material was encountered. The drifts then were cross-cut and the tunnel arch was rimmed out so the wall plates and steel arch ribs could be installed on centers as required to support the ground. Next, the core inclosed by the supports was removed and the top heading face thus opened up was carried forward. Excavation was carried on for one tunnel at a time with headings being driven simultaneously from both ends, completing the entire top heading before excavating the bench.

In some places during excavation of the top heading, heavy wet ground, with water flowing at rates up to 150 g.p.m., was encountered. The heading was advanced at such points by pioneering 5x7-ft. drifts beyond the face, one on each side of the tunnel at elevation of the wall plates, for a distance of 10 ft., then extending the wall plates and rimming out the arch so that the steel arch ribs could be installed. After the supports were placed the core was removed and the heading again was established. Usually, however, it was feasible to excavate a 10-ft. round in the regular manner before placing the steel supports.

Small jumbos, mounted on flat car trucks, were designed to facilitate drilling in both the top heading and bench sections. Each jumbo was equipped with one working deck and four Worthington automatic drifter drills, two being mounted above the deck and two at ground elevation.

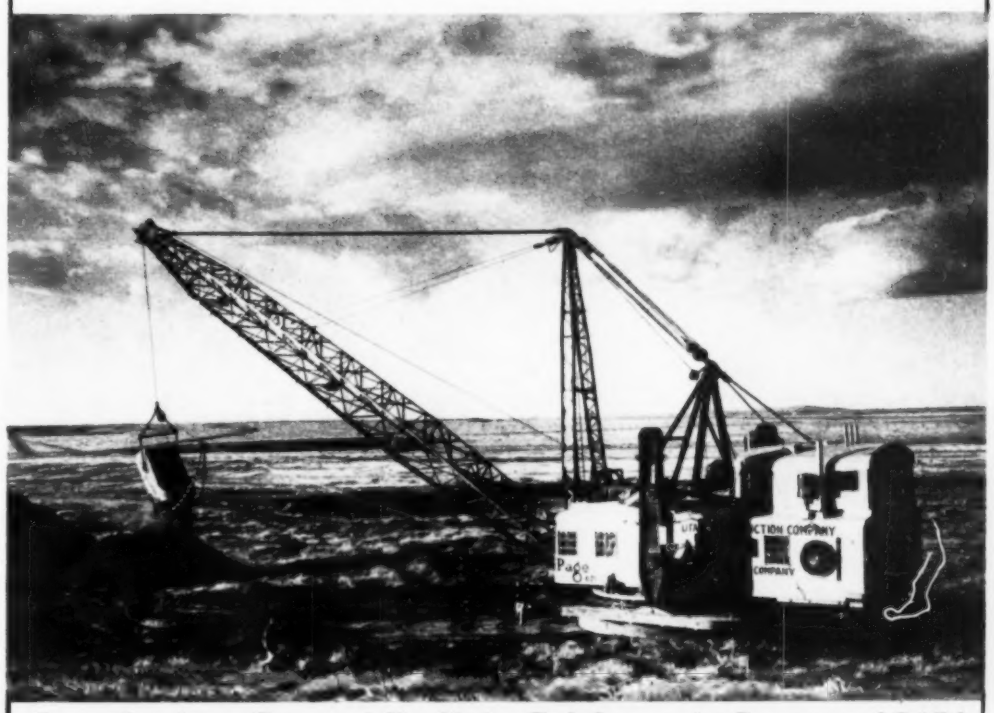
Owing to the distance between the three tunnels it was not considered feasible to install a centralized air compressor plant. When excavation was completed in one tunnel, certain units were moved to the next location while other units were left behind for use in placing the concrete lining.

Compressor Plant — The compressor plant was conveniently located near the portal of the tunnel and was made up of four Garner-Denver units, each of 360 c.f.m. capacity and powered by a 75-hp. electric motor, one Sullivan diesel-powered unit of 480 c.f.m. capacity, one 700 c.f.m. capacity horizontal Gardner-Denver unit, one 600 c.f.m. capacity Ingersoll-Rand unit and one 700 c.f.m. capacity Sullivan hori-

(Continued on page 104)

PAGE TWO-ENGINE DIESEL-POWERED WALKING DRAGLINE

One engine for loading and hoisting
Another separate engine for swinging



On canal work near Tucumcari, New Mexico, Utah Construction Company and Griffith Company use this Page Walker, powered by two Page horizontal Diesels, one mounted above the other. A heavy-duty 6½-cubic-yard Page Bucket is used on a 110-foot boom.

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(Continued from page 103)

zontal unit, total capacity of the plant being 3,920 c.f.m. at a pressure of 115 lb. per square in. At the present time the five smaller units are supplying power to the drills and equipment used in excavating tunnel No. 9. The three larger units were left at tunnel No. 10 for use in placing the concrete lining. Pressure is supplied to the drills in the tunnel heading at about 105 lb. per sq. in. and 5-in.-diameter air lines are used between the compressor plant and the heading.

Six lengths of drill steel were used ranging from 3½-ft. starters to a maximum length of 13½ ft., varying by 2-ft. increments between those lengths. Starters were dressed with 2¼-in. bits while the 13½-ft. lengths were dressed with 1⅝-in. bits. Sizes of bits for the intermediate lengths were ⅛-in. smaller in diameter for each successive length of steel.

Drill Steel

Bethlehem 1¼-in. hollow round and a Crucible variety of drill steel were used throughout. A shop was maintained near the compressor plant to sharpen the drill steel. About 50 tons of drill steel in assorted lengths were supplied. Steel was heated in oil furnaces of shop design and was sharpened by two Ingersoll-Rand Type 50 compressed air sharpeners. The degree of heat was judged by the color of the steel which varied from "cherry-red" to "snowball-white." Shanks were oil-tempered as far as the lugs and bits were tempered in cold water to obtain proper hardness. Breakage of steel was slight. Considerable plugging was experienced but most of this was easily removed by heating the steel and applying compressed air. If this failed the material was drilled out. The average amount of drill steel sharpened daily varied from 700 to 1,500 pieces, depending on the nature of the rock.

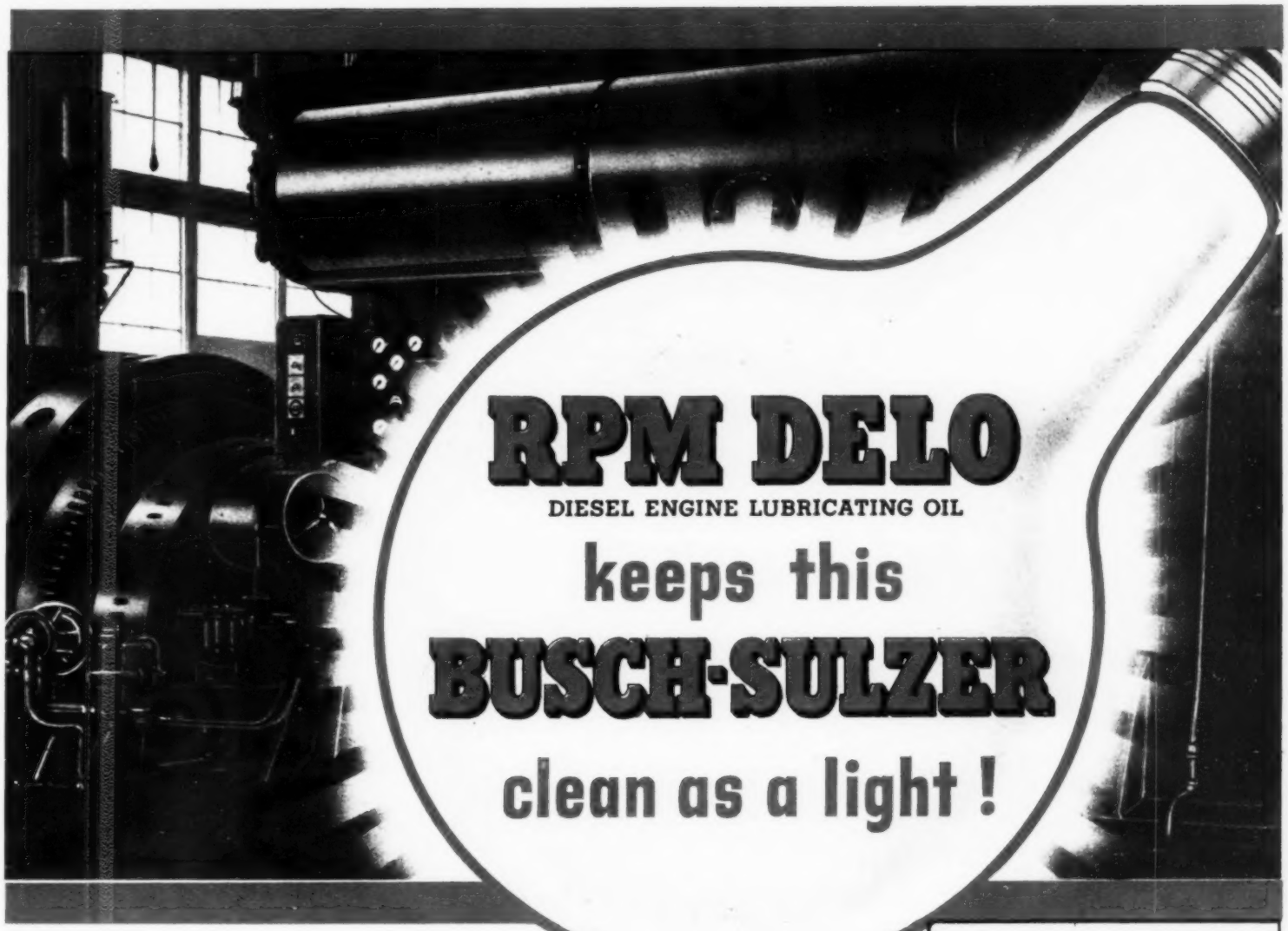
In drilling, loading and mucking for both the top heading and bench a daily progress of 20 ft. was maintained. Headings were drilled in 5-, 7-, 9-, and 11-ft. rounds, depending on the character of the rock. An average 11-ft. top heading round was made up of 22 holes loaded with approximately 160 lb. of 40 per cent gelatin dynamite. (See Fig. 2). An average 11-ft. bench round consisted of 24 holes loaded with approximately 170 lb. of 40 per cent gelatin dynamite. (See Fig. 2). The average bench or top heading round broke 10 ft. ahead and removed from 100 to 125 cu. yd. of muck.

Two Conway mucking machines were used to load the muck into 5-cu.yd. capacity Western side-dump cars. Westinghouse 7,500-lb. drawbar capacity electric locomotives, operating from either trolley lines or storage batteries, were used with an average of three cars per train. Stub spur tracks were used within the tunnels to facilitate switching during loading of muck trains.

Fourth Contract—5 Tunnels

The fourth tunnel contract includes earthwork and structures between the Pit River bridge and O'Brien Creek bridge, a

(Continued on page 106)



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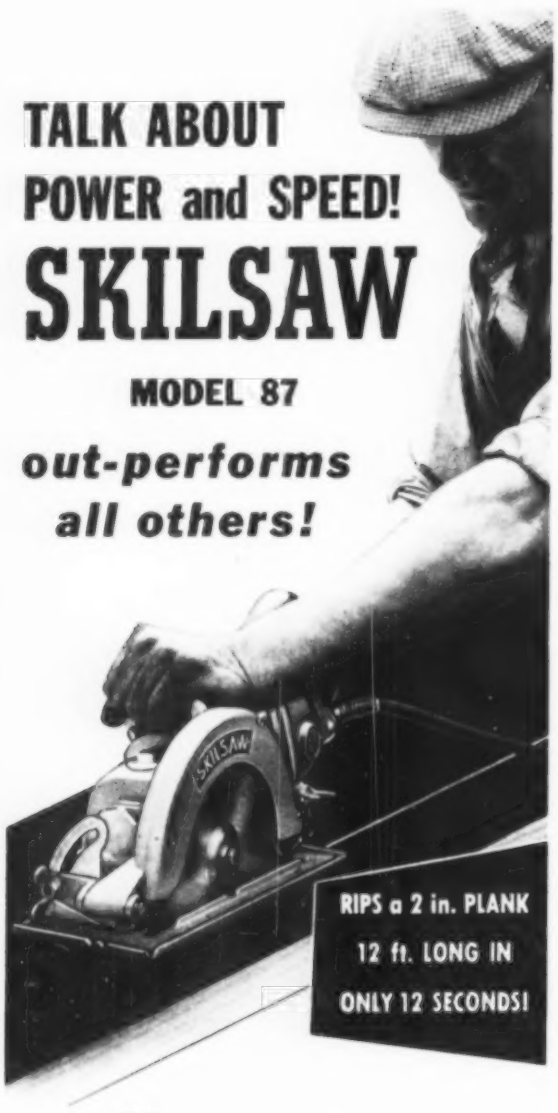
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(Continued from page 104)

distance slightly in excess of 5 mi. within which 5 tunnels are located: tunnel No. 3, 1,790 ft. long; tunnel No. 4, 856 ft. long; tunnel No. 5, 1,900 ft. long; tunnel No. 6, 745 ft. long; and tunnel No. 7, 1,605 ft. long.

A. Teichert & Son, Inc., United Concrete Pipe Corp., and Ralph A. Bell combined as one firm to bid this work at $1,857,-567.50. Tunneling is being done by the United Concrete Pipe Corp. and Ralph A. Bell of Los Angeles, while A. Teichert & Son, Inc., of Sacramento is performing the earthwork and building the miscellaneous structures included under this contract. As previously stated, operations of the United Concrete Pipe Corp. under the second tunnel contract and under the fourth tunnel contract are being carried out under the same general procedure and with practically the same plant.

The top-heading and bench method of excavation is being used by this contractor in the five tunnels. The method of getting started underground is identical with that outlined above for the third tunnel contract. Drilling jumbos were practically identical, except that this contractor is using Gardner-Denver Model IFAS automatic feed drifter drills.

Compressor Layout

Unique among the features of the tunnel plant is the compressor layout which supplies air to all five tunnels from a central location between tunnels No. 4 and 5. Six-inch diameter air lines reach as far as the south heading of tunnel No. 3, more than 3,000 ft. away, and the north heading of tunnel No. 7, more than 2½ mi. away from the compressor plant. Eight Gardner-Denver 360 c.f.m. capacity units, each powered with a 75 hp. electric motor, provide a total plant capacity of 2,880 c.f.m. at a pressure of 115 lb. per square inch in order to maintain 100 lb. at the drills in each of the three headings now being driven.

Tunnel headings are being drilled in 7-, 9-, and 11-ft. rounds, depending on the nature of the ground. Bethlehem 1¼-in. hollow round drill steel is used throughout and is sharpened in a shop adjacent to the compressor plant. Steel is heated in 24x46-in. oil furnaces of shop design each having a capacity of 30 pieces of steel per heating and using about 40 gal. of diesel fuel in 8 hr. Bits are heated to a temperature of 1,300 deg. F. and tempered in cold water while the shanks are heated to 1,200 deg. F. and tempered in oil for about 7 in. of their length. One Ingersoll-Rand and one Gardner-Denver compressed air sharpener are used. From 250 to 350 pieces of drill steel are required for each round and about 1,500 pieces of varying length are sharpened every 24 hr. to supply the three headings currently being driven. Lengths of steel and sizes of bits are identical with those for the other contracts.

The average 11-ft. top heading round consisted of 48 holes loaded with approximately 375 lb. of 40 per cent gelatin dynamite and removed from 100 to 125 cu. yd. of muck. (See Fig. 3). The average 11-ft. bench round consisted of 50 holes loaded with approximately 350 lb. of 40 per cent gelatin dynamite, also breaking about 100 to 125 cu. yd. from the face. (See Fig. 3). Average daily progress for either the top heading or the bench was 20 ft.

Western side-dump cars of 5-cu. yd. capacity pulled by electric trolley and storage battery locomotives were used to remove the muck. California type switches were used behind the mucking machines to facilitate switching of cars.

Rock in these tunnels consisted chiefly of shales, sandstone and quartzite of the Bragdon formation, intruded by igneous dikes.

Personnel—The Southern Pacific Railroad relocation at Shasta Dam is a construction feature of the Central Valley Project being built by the United States Department of the Interior, Bureau of Reclamation. Work is being performed under the direction of Harold L. Ickes, Secretary of the Interior, and the following officials of the Bureau of Reclamation: John C. Page, commissioner; R. W. Walter, chief engineer; Walker R. Young, supervising engineer, Central Valley Project; Ralph Lowry, construction engineer, Kennett Division, Central Valley Project; and Roy M. Snell, field engineer in direct charge of the railroad relocation.

Construction superintendents for the tunnel contractors are Axel Carlson, United Concrete Pipe Corp.; Swan Dalberg, R. G. Clifford Co.; and Pete Brisbois, West Construction Co.

* * *

Pennsylvania Turnpike Bridges

(Continued from page 66)

structures.

Rigid-Frame Overheads — Overhead structures presented more of a problem. Considerable study was given at the beginning of the program to determine the most satisfactory type of crossing, and many different designs were compared with primary consideration to economy and important secondary consideration to appearance within reasonable cost limits. The study revealed that for single-span crossings the reinforced-concrete rigid frame was superior to all other types, being not only the cheapest but also the most adaptable to satisfactory architectural treatment at low cost. This design was adopted for all single span crossings where foundation conditions and skew made its use practicable.

There are a total of 53 rigid-frame structures, of which eight occur at interchanges. Except for those at interchanges, the right angle span of practically all of these structures is 78 ft. clear. They were designed for skews of intersections varying from 60 deg. to 90 deg. It should be noted that in all cases skews refer to angles of intersection.

Where foundation conditions or excessive skews rendered the rigid-frame type

of crossing ineffective, either of two other types of grade separation structures was selected. The first of these is the reinforced-concrete T-beam type used in twin spans. Extended study was given to this type of design, particularly with reference to the treatment of the pier, with a resulting design superior in appearance to the ordinary structure of this type. The remaining grade separation structures are of the plate girder type, most of which cross the Turnpike in a single span. Where the skew is more acute than 45 deg., it was necessary to build the plate girders in twin spans. In one case, where the angle of intersection is 20 deg. 45 min., a special three-span design was adopted.

Double Curb

T-beam structures used for undergrade crossings are unusual only because of the large roadway width and of the manner in which the parapets have been treated. A double curb was adopted for all structures at Turnpike grade. The profile of this curb, selected only after careful study, is designed to prevent not only the fenders of passenger cars, but also the overhangs of buses and trucks, from striking the parapet regardless of the angle of approach of the vehicle. Because of the short span and wide roadway width of most of the structures at grade it was felt that ordinary parapet design would be unsatisfactory in appearance. After study, the type now in use, with rounded ends and stream-line scorification, was adopted. A desirable effect has been obtained with this design.

In a number of cases the distance, grade, to grade, on undergrade crossings was such that extremely high abutments would have been necessary for structures of plate girder, T-beam or rigid-frame type. In these instances, arches under the fill are utilized as grade separation structures. There are six such structures, ranging in span from 30 to 56 ft., carrying fills up to 40 ft. over the crowns, giving lengths of arch in excess of 200 ft.

Interchanges involve eleven structures carrying ramps over the Turnpike or the Turnpike over ramps. Of these structures, eight are rigid frames and three are steel plate girders. Special attention was given to the appearance of all these structures with the object of creating a good impression upon motorists entering the Turnpike.

Viaducts

Turnpike design involves only six structures of sufficient length to be considered as viaducts. Two of these structures, over the Juniata River and Dunning Creek at Bedford Narrows, are of continuous plate-girder design. The remaining four comprise a crossing of the Juniata River in Bedford County; Arona viaduct over Little Sewickley Creek and the Pennsylvania R.R.; Somerset viaduct over the Baltimore & Ohio R.R.; and New Stanton viaduct over Little Sewickley Creek, West Penn trolley, Pennsylvania R.R. and a state highway. The Juniata and Arona viaducts are continuous plate-girder design,

(Continued on page 108)

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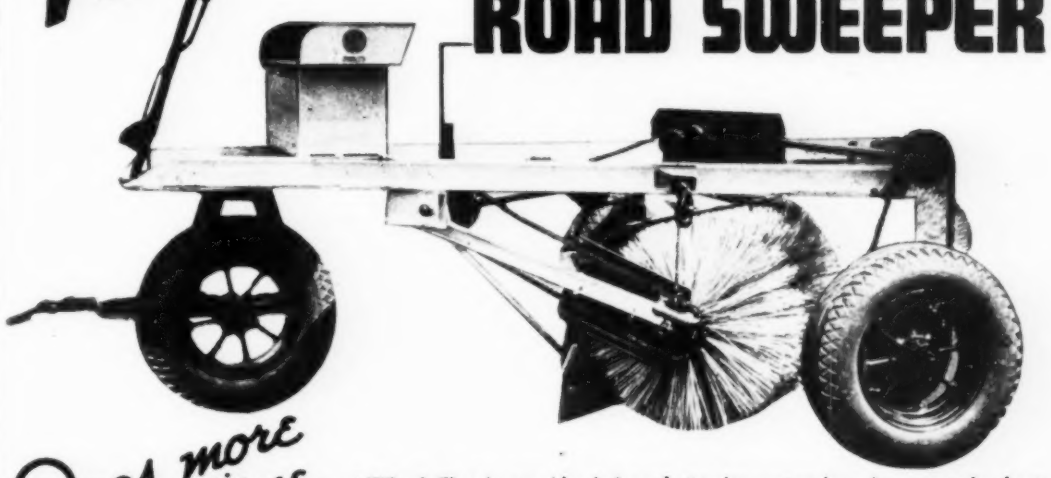
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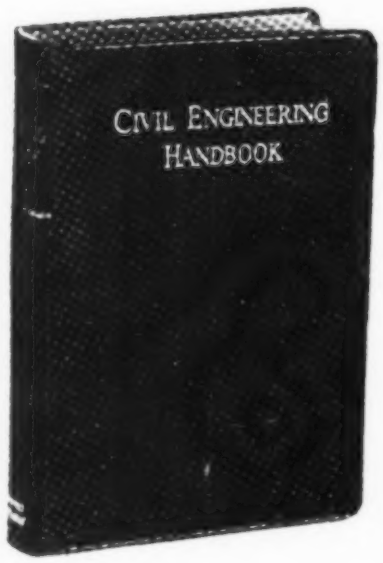
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(Continued from page 107)

and the Somerset viaduct is a continuous I-beam structure.

New Stanton viaduct is the largest structure along the Turnpike. It is of reinforced concrete, with an open spandrel arch (of 170 ft. clear) for its middle span, flanked by three approach spans on either side. Approach spans at each side comprise two of 84 ft. and one of 48 ft., and each approach group consists of a rigid-frame middle span flanked by restrained beams on both sides. This design eliminates the high temperature stresses involved in multiple-span rigid-frame construction without any considerable loss in the economy of rigid-frame design. The entire viaduct is on a superelevated horizontal curve, and the structure carries, in addition to the regular Turnpike cross-section, an accelerating lane from the adjacent New Stanton interchange.

Because of the necessity of getting the New Stanton viaduct under contract at an early date, it was necessary that great speed be used in the design and preparation of contract drawings for the structure. To satisfy this need, the entire design was made and contract drawings completed within a period of six weeks without interfering with the design and preparation of drawings for numerous other structures included in sections being advertised during that period.

Acknowledgement

Data for the accompanying notes were supplied by Richard F. Graef, bridge engineer, Pennsylvania Turnpike Commission, who has been in charge of this work from the beginning. H. E. Kunsch is assistant bridge engineer. Heading all engineering activities is Samuel W. Marshall, chief engineer.

* * *

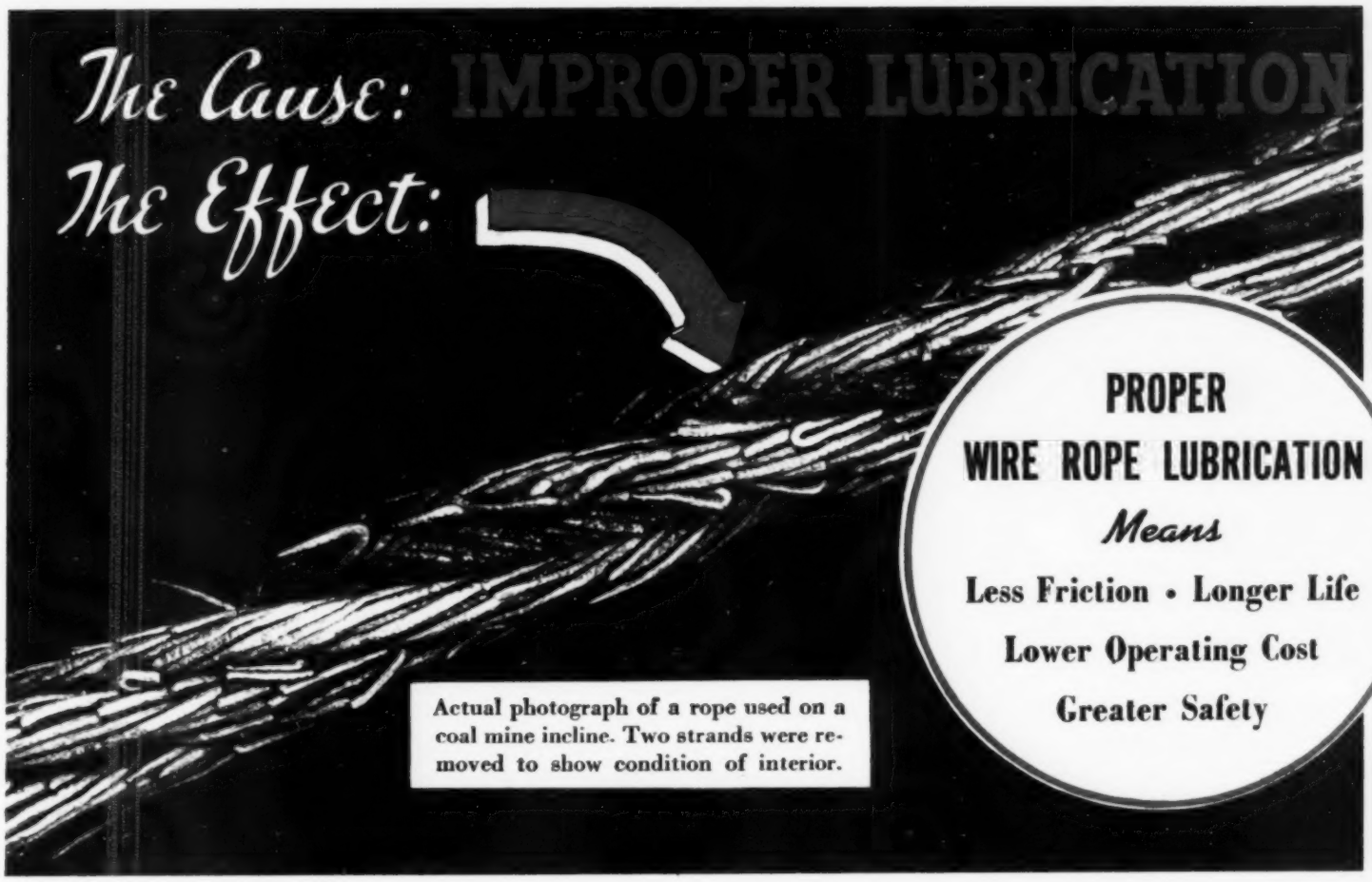
JAMESTOWN BRIDGE

(Continued from page 71)

quired steel bracing, this bracing was left in place when the shafts for the piers were concreted.

Just below and above the water line on the central piers a granite facing was placed for protection against ice and weather. On smaller shafts the same function is fulfilled by wrought iron facings.

Parsons, Klapp, Brinckerhoff & Douglas, of New York City, served as designing and consulting engineers on the project, with William H. Bruce as resident engineer. Contractors included Merritt-Chapman & Scott Corp., of New London, Conn., on the substructure; Harris Structural Steel Co. on the superstructure; Lipset-Jung Co., of Brooklyn, N. Y., on the concrete deck; and P. Romano & Son, of Warren, R. I., on the west mainland approach. For PWA, Thomas Iverson was resident engineer inspector.



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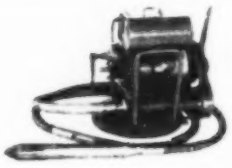
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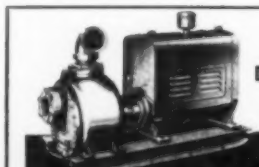
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Associated architects on the Arrowhead Springs Hotel were Paul Williams and Gordon Kaufman. The builder was Wm. Simpson Construction Company.

